PREVALENCE OF *TINEA CAPITIS* INFECTION AMONG CHILDREN IN INTERNALLY DISPLACED PERSONS (IDP) CAMP

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SEPTEMBER, 2025

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THIS PROJECT IS SUBMITTED TO THE DEPARTMENT OF MEDICAL LABORATORY SCIENCE, UNIVERSITY OF BENIN IN PARTIAL FUFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELORS DEGREE IN MEDICAL LABORATORY SCIENCE.

SEPTEMBER, 2025

CERTIFICATION

This is to certify that this project work was carried out by **MOMOH JESUSEME JUDITH** with matriculation number **BMS2001181** under my supervision, in partial fulfilment of the requirement for the award of Bachelor of Medical Laboratory Science (BMLS) Degree.

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DEDICATION

This project work is dedicated to God Almighty for the grace, knowledge, wisdom, and sustenance throughout my stay in the University of Benin. I am also dedicating this project work to my parents and siblings who have stood by me all through the course of this project.

ACKNOWLEDGEMENTS

Firstly I thank God Almighty for His unconditional love, grace, and my unfeigned gratitude goes to my supervisor Dr. Mrs. N.A Olise for all her efforts and guidance for making this work a success.

Also, I immensely appreciate the Head of the Department, Dr. (Mrs.) Z. Omoruyi and all the lecturers in y department. I am very much thankful to all that stood by me all through the process. My appreciation and love goes to Mr. Billie Jacob Momoh and Mrs. Mercy Enohuewalan Momoh, for their spiritual, moral and financial support.

Also, my heartfelt appreciation goes to my siblings: Sharon Momoh, Joan Momoh, Nancy Momoh. To my friends and course mates particularly my reading partners; Mrs. Grace Nosakhare, David Igbinedion, Vera Iyoha for the role they played in helping me stay focused. Finally, my humongous appreciation goes to God Almighty for His unconditional love, grace, and protection.

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ABSTRACT

Tinea capitis is a contagious dermatophytic infection of the scalp that constitutes a significant public health concern, particularly among children in resource-limited environments. This study investigated the prevalence and dermatophyte species distribution of Tinea capitis among children in an Internally Displaced Persons (IDP) camp in Uhogua, Benin City, Edo State, Nigeria. A total of 160 children were examined, and scalp scrapings were collected and processed using standard mycological techniques. Dermatophyte isolates were identified based on colonial morphology and microscopic characteristics. Out of the 160 children sampled, 59 were positive for Tinea capitis, corresponding to an overall prevalence of 36.9%. Prevalence was slightly higher in females (38.9%) than in males (34.3%), though the difference was not statistically significant ($p = 0.276$).Children aged 6–10 years recorded the highest prevalence (41.8%), followed by 1–5 years (33.3%) and 11–15 years (33.3%), with no significant association between age and infection ($p > 0.05$). Six dermatophyte species were identified, with Trichophyton mentagrophyte (28.8%) being the most common, followed by Microsporum gypseum (18.6%), Trichophyton equinum (15.3%), Trichophyton rubrum (15.3%), Microsporum canis (13.6%), and Trichophyton epidermophyton (8.5%). The predominance of both anthropophilic and zoophilic species indicates multiple transmission routes within the camp. These findings highlight a considerable burden of Tinea capitis among children in IDP settings, underscoring the need for improved hygiene practices, routine screening, timely antifungal treatment, and targeted health interventions to mitigate the spread and consequences of the infection.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Tinea capitis is a common superficial fungal infection of the scalp and hair shafts caused by dermatophytes, particularly species of *Trichophyton* and *Microsporum*. These fungi penetrate keratinized tissues through the production of keratinases and other proteolytic enzymes which degrade the protective keratin layer, leading to colonization of the scalp and hair follicles (Okafor, 2020). Although *Tinea capitis* is frequently observed in general populations, its prevalence is significantly higher among children due to their developing immune systems and frequent close contact in communal environments (Amuta, 2020). The disease can present in a spectrum of forms ranging from non-inflammatory scaly patches and alopecia to painful inflammatory lesions. While mild infections may resolve spontaneously, chronic or untreated cases can result in secondary bacterial infection, permanent scarring alopecia, and psychosocial distress among children (Chukwu, 2021).

The distribution and persistence of *Tinea capitis* are strongly influenced by environmental and socioeconomic conditions. Internally Displaced Persons (IDP) camps provide unique conditions that favor the spread of dermatophytic infections. Typically, these camps are characterized by overcrowding, inadequate sanitation facilities, and limited access to clean water, which increases the risk of fungal transmission through both direct and indirect contact (World Health Organization, 2021). Shared items such as combs, bedding, and clothing further accelerate the transmission cycle. Malnutrition, psychosocial stress, and compromised immunity, which are prevalent in displaced populations, increase susceptibility to infection and contribute to sustained reservoirs of dermatophytes within the camp population (Ejezie, 2022).

The burden of fungal infections in displaced settings can be compared to the accumulation of toxic exposures in industrial environments. In the same way that inhalation of heavy metals during industrial processes generates oxidative stress that disrupts cellular balance, the overcrowded and resource-poor conditions of IDP camps disrupt hygienic balance and create an environment favorable to the continuous circulation of fungal pathogens (Olorunfemi, 2023). Consequently, children in these camps often experience repeated or chronic dermatophytosis, which not only undermines their physical health but also impacts social interaction, school attendance, and overall quality of life (Ngouateu, 2023).

Recent epidemiological surveys in African regions demonstrate that the prevalence of *tinea capitis* among school-aged children ranges from 10% to over 70%, depending on the geographical area, diagnostic approach, and socioeconomic conditions (Nweze, 2021). In Nigeria, large household size, infrequent hair washing, and poor environmental sanitation have been identified as significant risk factors, while studies in Cameroon highlight the role of close sibling contact and shared sleeping spaces (Ngouateu, 2023). These findings suggest that IDP camps, which combine these risk factors at extreme levels, represent a high-risk environment for dermatophyte transmission. Investigating the prevalence of *Tinea capitis* in such settings is therefore essential for designing effective interventions, guiding public health responses, and protecting vulnerable child populations.

1.2 Statement of Problem

Tinea capitis is a scalp infection caused by dermatophytes which thrive in keratinized tissues. Though some fungal species may remain asymptomatic or cause mild irritation, others at higher levels of colonization result in itching, scaling, hair loss, and even permanent alopecia in children. This burden is worsened in settings such as Internally Displaced Persons (IDP) camps where overcrowding, poor sanitation, malnutrition, and close contact provide favorable conditions for transmission. The persistence of these infections not only affects child health but also poses psychosocial and public health challenges. Hence, this study was designed to investigate the prevalence and associated risk factors of *Tinea capitis* infection among children in IDP camps.

1.3 Justification of Study

There are conditions in Internally Displaced Persons (IDP) camps that would not normally be found in standard community settings. Some of them include overcrowding, poor sanitation, limited access to clean water, malnutrition, and the sharing of personal items such as combs and bedding. Exposure to these conditions could and can increase the transmission, persistence, and severity of *Tinea capitis* infection among children living in such camps.

1.4 Aim of Study

The aim of this study is to investigate the prevalence and associated risk factors of *Tinea capitis* infection among children living in Internally Displaced Persons (IDP) camps.

1.5 Specific Objectives

The specific objectives of this study are to:

1. determine the prevalence of *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps.
2. identify the risk factors associated with *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps.
3. assess the health and psychosocial implications of *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps

1.6 Research Questions

4. What is the prevalence of *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps?
5. What are the risk factors associated with *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps?
6. What are the health and psychosocial implications of *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps?

1.7 Research Hypothesis

Null Hypothesis (H_0)

Tinea capitis infection does not have a statistically significant prevalence among children in Internally Displaced Persons (IDP) camps. Identified risk factors do not have any significant association with *Tinea capitis* infection among children in Internally Displaced Persons (IDP) camps. *Tinea capitis* infection does not have any significant effect on health and psychosocial outcomes among children in Internally Displaced Persons (IDP) camps.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 *Tinea Capitis* Infection

Tinea capitis is a contagious dermatophytic infection of the scalp and hair shafts that predominantly affects pre-pubertal children but can occur at any age; it is caused mainly by fungi in the genera *Trichophyton* and *Microsporum* and remains a major public-health problem in low-resource and crowded settings (Gupta, 2024). Clinically it ranges from subtle scalp scaling and patchy non-scarring hair loss to florid inflammatory forms, and left untreated some variants may lead to scarring alopecia with permanent hair loss and psychosocial consequences for the child (Ion, 2024). The global burden is uneven: prevalence estimates vary widely by region, with many studies from sub-Saharan Africa and parts of Asia reporting particularly high rates among school-age children, highlighting the disease's continued importance in public-health and pediatric dermatology (Alemu, 2024).

The pathogenesis of tinea capitis involves fungal adherence to keratinized structures followed by invasion of the hair shaft (either ectothrix or endothrix patterns), production of keratin-degrading enzymes, and a host immune response that determines the clinical picture (Ion, 2024). Zoophilic species (animal-origin) tend to provoke a more intense inflammatory reaction sometimes progressing to kerion while anthropophilic species more often cause indolent, persistent scalp colonization; this distinction matters because it influences clinical severity, transmission dynamics, and even therapeutic choices (Ion, 2024). Host factors such as age (pre-pubertal sebum composition offers less innate protection), household crowding, hygiene practices, and genetic susceptibility have been associated with increased risk, explaining why outbreaks cluster in schools and households (Alemu, 2024).

Epidemiology in the last decade has shown regional and temporal shifts in the dominant dermatophyte species, driven by population movement, urbanization, and local animal reservoirs; for example, *Trichophyton* species have become more prominent in some urban North American and European communities while *Microsporum* species remain common in other regions, a pattern that affects both diagnosis and the likely response to certain antifungals (Gupta, 2024). Recent community and school-based studies continue to report high prevalence in many low- and middle-income settings often between about 20–40% in selected school populations underscoring the ongoing public-health burden (Alemu, 2024). These epidemiological data emphasize the need for context-specific surveillance and for clinicians to be aware of local species patterns when selecting empiric therapy (Gupta, 2024).

Diagnosis combines clinical inspection with simple office tools and laboratory methods: careful scalp exam (including recognition of "comma", "corkscrew", or "black dot" hairs on close inspection or dermoscopy) and then confirmation by direct microscopy, culture, or newer molecular methods where available (Ion, 2024). Dermoscopy has grown as a useful, noninvasive adjunct that can quickly raise suspicion and guide early treatment while awaiting mycology results; however, studies and audits show that many clinicians still underutilize confirmatory testing and treat empirically, which can complicate surveillance and obscure true species distributions (Gupta, 2024). Proper sample collection (hair pluck or scalp scrapings) and communication with the laboratory are therefore important steps for accurate case confirmation and epidemiologic tracking.

Systemic antifungal therapy is required to eradicate hair-shaft infections; recommended agents include griseofulvin, terbinafine, itraconazole, and fluconazole, with choice and duration influenced by the likely species, patient age, drug availability, and safety considerations (Ion, 2024). Recent reviews and clinical guidance (2019–2024) emphasize that terbinafine tends to achieve higher mycological cure rates for *Trichophyton* infections, whereas griseofulvin remains effective for many *Microsporum* infections yet local drug availability, formulation (suspension for young children), cost, and adherence remain practical constraints in many settings (Gupta, 2024; Ion, 2024). Additionally, topical adjuncts (antifungal shampoos) and household contact screening/treatment are important public-health measures to reduce transmission; surveillance for treatment failure and possible resistance is an emerging concern in some regions.

Prevention and control require a mixture of clinical, educational, and public-health interventions: early case detection, appropriate systemic therapy, treatment or screening of close contacts, regular cleaning of fomites (combs, pillows, hats), and school-based health education targeted at caregivers and teachers (Alemu, 2024). Because many recent field studies (2019–2024) identify overcrowding, shared hair-cutting tools, animal contact, and lower parental education or socioeconomic status as recurrent risk factors, integrated community interventions that address these social determinants along with readily available diagnostic and treatment services are likely to have the greatest impact on lowering prevalence and preventing stigmatization of affected children (Alemu, 2024; Gupta, 2024). Future research priorities flagged in the recent literature include improved rapid diagnostics, region-specific treatment trials, and implementation research on cost-effective community control strategies.

2.1.1 History and Nomenclature of *Tinea capitis*

The history of *Tinea capitis* dates back to ancient times, with early descriptions found in medical writings that recognized its contagious nature and characteristic scalp lesions. Ancient physicians such as Hippocrates and Galen made references to scalp diseases that closely resembled what is now known as *Tinea capitis*, although the precise fungal cause was not understood at the time. It was not until the mid-19th century that the etiological agent of the disease was identified as a fungal infection. The discovery of dermatophytes by David Gruby in 1841 marked a turning point in the understanding of *Tinea capitis*, as he demonstrated that fungi could invade the hair shaft and scalp, thereby establishing the foundation of modern medical mycology (Gupta, 2024).

The nomenclature of *Tinea capitis* has evolved in line with advances in microbiology and taxonomy. The term "Tinea" originates from the Latin word for "worm," reflecting the ancient belief that worm-like organisms caused ringworm infections of the skin and scalp. “capitis,” derived from Latin for “head,” designates the anatomical site of infection. Although initially regarded as a single disease entity, later research revealed that *Tinea capitis* could be caused by multiple species of dermatophytes, predominantly *Trichophyton* and *Microsporum*, leading to a refined classification based on pathogen type and invasion pattern (Ion, 2024).

Historically, the condition was widespread in Europe and North America during the 19th and early 20th centuries, often associated with overcrowded schools, orphanages, and poor hygiene conditions. In some countries, children diagnosed with *Tinea capitis* were excluded from school until treatment was completed, highlighting its social and educational impact (Alemu, 2024). Public health responses in the mid-20th century included mass screening and treatment programs, especially in schools, which significantly reduced prevalence in developed countries. However, the infection remains highly endemic in many low- and middle-income countries, particularly across sub-Saharan Africa and parts of Asia, where socioeconomic factors and limited access to healthcare continue to sustain high transmission rates (Alemu, 2024).

Recent molecular studies have added precision to the nomenclature and classification of Tinea capitis-causing organisms. Advances in DNA sequencing have led to reclassification of several dermatophyte species, improving understanding of their phylogenetic relationships and epidemiology (Gupta, 2024). For example, genetic studies have clarified the differences between *Trichophyton tonsurans* and other closely related species, which has important implications for clinical diagnosis and treatment strategies. This modern molecular perspective complements historical descriptions and ensures more accurate identification of pathogens responsible for outbreaks.

The history and nomenclature of *Tinea capitis* therefore reflect a progression from early descriptive medicine through the germ theory of disease to modern molecular taxonomy. While the term "*Tinea capitis*" has remained consistent in medical usage, its understanding has deepened with the recognition of distinct clinical patterns, species-specific presentations, and variable epidemiological distributions across regions and time periods (Ion, 2024). This evolution underscores the importance of continuous surveillance and adaptation of diagnostic methods in response to shifting pathogen patterns.

2.1.2 Etiological Agents of Tinea Capitis

The etiological agents of *Tinea capitis* are dermatophyte fungi belonging mainly to the genera *Trichophyton* and *Microsporum*, which are keratinophilic organisms capable of invading the keratinized tissues of the scalp and hair. These fungi are categorized into anthropophilic species, which primarily infect humans; zoophilic species, which are transmitted from animals; and geophilic species, which reside in soil but occasionally cause human disease (Gupta, 2024). Among these, anthropophilic species such as *Trichophyton tonsurans* and *Trichophyton violaceum* are most frequently implicated in human-to-human transmission and are responsible for chronic, widespread infections, particularly in school-aged children (Ion, 2024).

Microsporum species, especially *Microsporum canis*, remain important etiological agents in regions with high levels of animal contact, as domestic pets such as cats and dogs serve as common reservoirs. Infections caused by *M. canis* are often associated with more inflammatory presentations compared to anthropophilic *Trichophyton* infections, which are typically less inflammatory but more persistent (Alemu, 2024). The distinction between anthropophilic and zoophilic strains is critical, as it not only shapes clinical manifestations but also influences patterns of spread within communities and households.

Globally, the distribution of etiological agents has undergone significant shifts in the past few decades. In North America and parts of Europe, *T. tonsurans* has become the predominant cause of tinea capitis, largely replacing *M. audouinii*, which was historically common in these regions (Gupta, 2024). Conversely, in many African and Asian countries, *M. canis*, *T. violaceum*, and *T. soudanense* remain widespread, reflecting the impact of socioeconomic conditions, cultural practices, and environmental exposures (Alemu, 2024). This variation underscores the importance of region-specific epidemiological surveillance in guiding diagnosis and treatment.

Molecular studies conducted between 2019 and 2024 have further refined understanding of the etiological diversity of dermatophytes. DNA sequencing has revealed cryptic species and clarified taxonomic ambiguities, leading to more accurate identification in clinical settings (Ion, 2024). For instance, differentiation of *T. interdigitale* from *T. mentagrophytes* using molecular markers has helped explain differences in virulence and antifungal susceptibility. These advances provide clinicians and researchers with tools to track emerging strains and monitor antifungal resistance trends.

The pathogenesis of infection varies according to the etiological agent and its mode of hair shaft invasion. Dermatophytes can invade in ectothrix patterns, where fungal spores coat the exterior of the hair shaft, or endothrix patterns, where they penetrate and fill the hair shaft interior.

Trichophyton species are more commonly associated with endothrix invasion, while *Microsporum* species are linked to ectothrix infection (Gupta, 2024). These invasion patterns not only assist in diagnostic differentiation under microscopy but also influence clinical outcomes and treatment responses.

In summary, the etiological agents of tinea capitis reflect a complex interplay of fungal species, ecological niches, and host interactions. Regional variations in predominant pathogens highlight the necessity for localized diagnostic strategies and tailored therapeutic approaches. Continuous surveillance, supported by molecular tools, is essential to detect shifts in causative species and to ensure effective management of this persistent public-health challenge (Alemu, 2024).

2.1.2.1 Dermatophyte Fungi

Dermatophyte fungi are a specialized group of keratinophilic organisms that colonize and infect keratinized tissues such as the skin, hair, and nails. They are the principal etiological agents of tinea capitis, with infection occurring when these fungi invade the scalp and hair shaft (Gupta, 2024). Belonging to the genera *Trichophyton*, *Microsporum*, and *Epidermophyton*, dermatophytes are adapted to utilize keratin as a nutrient source through the secretion of keratinases and other proteolytic enzymes, which enable them to break down host tissues and establish infection (Ion, 2024). Although more than forty dermatophyte species exist, only a limited number are commonly implicated in tinea capitis, with *Trichophyton* and *Microsporum* species being the most prevalent worldwide (Alemu, 2024).

These fungi are further classified based on their ecological niche into anthropophilic, zoophilic, and geophilic dermatophytes. Anthropophilic species such as *Trichophyton tonsurans* and *Trichophyton violaceum* are transmitted predominantly from human to human and are responsible for chronic, low-grade infections that spread rapidly in crowded environments like schools (Gupta, 2024). Zoophilic dermatophytes, including *Microsporum canis* and *Trichophyton verrucosum*, originate from domestic or farm animals and tend to provoke more inflammatory scalp lesions due to their less-adapted interaction with the human host (Alemu, 2024). Geophilic species such as *Microsporum gypseum* are soil-dwelling fungi that occasionally cause scalp infections, though they are far less common (Ion, 2024).

Morphologically, dermatophytes exhibit distinct microscopic features that assist in diagnosis. *Microsporum* species are characterized by large, spindle-shaped macroconidia with rough walls, while *Trichophyton* species generally produce smaller, smooth-walled microconidia, often in grape-like clusters (Gupta, 2024). These morphological traits, alongside culture characteristics, traditionally guided species identification in clinical laboratories, though molecular methods are increasingly used for precise differentiation, especially in cases of overlapping morphology or cryptic species (Ion, 2024).

The pathogenicity of dermatophyte fungi depends on both fungal virulence factors and host susceptibility. Fungal enzymes such as keratinases, lipases, and subtilisins enable penetration of the stratum corneum and hair shafts, while other factors help evade host immune responses (Gupta, 2024). At the host level, factors such as age, immune status, and sebum composition influence susceptibility to infection. This explains why *Tinea capitis* is far more prevalent in prepubertal children, whose scalp environment provides less antifungal protection compared to adults (Alemu, 2024).

Recent advances in molecular biology and epidemiological studies from 2019 to 2024 have shed new light on the diversity and spread of dermatophyte fungi. DNA sequencing and phylogenetic analyses have clarified taxonomic ambiguities, leading to reclassification of some strains and better understanding of antifungal resistance mechanisms (Ion, 2024). These insights are crucial for guiding treatment decisions, as resistance to common antifungals such as terbinafine has been increasingly documented in certain dermatophyte species.

2.1.2.2 Common Species Causing Tinea Capitis

The most common causative species of tinea capitis worldwide are members of the genus *Trichophyton*, with *Trichophyton tonsurans* being particularly significant. This anthropophilic dermatophyte has become the dominant species in North America, parts of Europe, and increasingly in some African countries (Gupta, 2024). *T. tonsurans* typically produces endothrix invasion, where fungal spores remain inside the hair shaft, leading to characteristic "black dot" alopecia. Its anthropophilic nature enables efficient human-to-human transmission, especially in schools and crowded households. Due to its chronic and persistent course, infections caused by *T. tonsurans* are often asymptomatic early on, contributing to silent community spread (Ion, 2024).

Another important *Trichophyton* species is *Trichophyton violaceum*, which is endemic in many African, Middle Eastern, and some Asian countries. *T. violaceum* is also an anthropophilic dermatophyte and produces chronic, low-grade infections, often with patchy hair loss and scaling (Alemu, 2024). Historically, this fungus was widespread in Europe but has largely declined following improved public health interventions, though sporadic cases are still reported in immigrant populations (Gupta, 2024). Its close relative, *Trichophyton soudanense*, is also highly prevalent in sub-Saharan Africa and presents with similar clinical features, highlighting the regional importance of these species.

Among zoophilic dermatophytes, *Microsporum canis* remains a leading cause of *Tinea capitis* in areas where animal contact, particularly with cats and dogs, is common. This species typically causes ectothrix invasion of the hair shaft and is associated with more inflammatory scalp lesions compared to anthropophilic fungi (Ion, 2024). Outbreaks of *M. canis* infections are frequently documented in households and communities where domestic pets serve as reservoirs, and infections are often characterized by erythema, scaling, and broken hairs. Although less chronic than *Trichophyton* infections, *M. canis* can cause significant discomfort and visible disfigurement in affected children (Alemu, 2024).

Other notable species include *Trichophyton verrucosum* and *Microsporum audouinii*. *T. verrucosum* is a zoophilic species linked to cattle and is occasionally transmitted to humans, usually causing highly inflammatory lesions such as kerion (Gupta, 2024). Though less common today, it remains an important etiological agent in rural areas where human–animal interaction is frequent. *M. audouinii*, on the other hand, was historically one of the most common causes of tinea capitis in Europe and North America but has dramatically declined due to public health measures. However, it continues to persist in parts of Africa, contributing to regional variations in species distribution (Alemu, 2024).

Globally, shifts in the distribution of these species highlight the dynamic epidemiology of tinea capitis. While *T. tonsurans* dominates in industrialized nations, *T. violaceum*, *T. soudanense*, and *M. canis* remain widespread in Africa, the Middle East, and Asia (Ion, 2024). These differences are shaped by cultural practices, socioeconomic conditions, and environmental exposures, underscoring the need for localized surveillance and species-specific management strategies. Continued monitoring of the common dermatophyte species is crucial, particularly with the growing concern of antifungal resistance, which has been reported in some strains of *Trichophyton* (Gupta, 2024).

2.1.3 Pathogenesis of *Tinea capitis*

The pathogenesis of tinea capitis involves a complex interaction between the dermatophyte fungi and the host environment. Infection begins when fungal spores, known as arthroconidia, come into contact with the scalp and hair shafts. These spores adhere to keratinized tissues through specialized adhesins and begin to germinate. Dermatophytes secrete keratinases, lipases, and proteases that degrade keratin, allowing penetration into the outer hair shaft and surrounding scalp tissue (Gupta, 2024). The successful colonization of the scalp is influenced not only by fungal virulence but also by the host's local defense mechanisms, such as the presence of fungistatic fatty acids in sebum, which are less developed in prepubertal children (Alemu, 2024).

The route of invasion differs depending on the fungal species. *Trichophyton* species typically cause endothrix infections, where spores penetrate and fill the interior of the hair shaft, resulting in the classic "black dot" pattern of alopecia (Ion, 2024). In contrast, *Microsporum* species usually cause ectothrix invasion, where spores coat the outside of the hair shaft, leading to hair fragility and breakage. These distinct invasion patterns are critical for both clinical diagnosis and understanding disease severity. Ectothrix infections often appear more inflammatory, whereas endothrix infections tend to be more persistent and difficult to eradicate (Gupta, 2024).

Host immune response also plays a central role in the pathogenesis of tinea capitis. Both innate and adaptive immunity are activated once dermatophytes invade the scalp. Antigen-presenting cells trigger T-cell mediated immune responses, particularly Th1 and Th17 pathways, which produce pro-inflammatory cytokines such as interferon-gamma and interleukin-17 (Ion, 2024). These immune reactions help limit fungal proliferation but may also contribute to clinical manifestations like erythema, scaling, and pustules. Zoophilic species, such as *Microsporum canis* and *Trichophyton verrucosum*, are less adapted to human hosts and thus often elicit a more robust inflammatory response, sometimes culminating in kerion formation (Alemu, 2024).

Another important factor in pathogenesis is the ability of dermatophytes to evade or modulate host defenses. Recent studies (2019–2024) show that dermatophytes produce metabolites and enzymes that suppress immune activity, allowing persistent colonization in chronic cases (Gupta, 2024). The chronic, low-grade infections seen with anthropophilic fungi such as *T. tonsurans* and *T. violaceum* illustrate this immune adaptation, where the fungus coexists with the host for long periods with minimal inflammatory damage. By contrast, the exaggerated immune response to zoophilic fungi reflects the lack of such adaptation.

In addition to fungal virulence and host immunity, environmental and social factors contribute to the pathogenesis of outbreaks. Overcrowding, poor hygiene, and shared grooming tools such as combs or clippers facilitate continuous re-inoculation of the scalp, prolonging infection and increasing transmission within households and schools (Alemu, 2024). The interplay of these biological and environmental determinants underscores why *Tinea capitis* remains highly prevalent in certain populations, despite being largely controlled in others.

2.1.3.1 Mode of Transmission

The transmission of *Tinea capitis* occurs primarily through direct or indirect contact with dermatophyte fungi, making it a highly contagious condition, especially among children. Direct human-to-human spread is the most common route for anthropophilic species such as *Trichophyton tonsurans* and *Trichophyton violaceum*. These species thrive in crowded environments like schools and orphanages, where close physical interactions facilitate rapid spread (Gupta, 2024). Children are particularly vulnerable because their immature scalp sebum lacks fungistatic fatty acids, which reduces their natural protection compared to adults (Alemu, 2024).

Indirect transmission also plays a major role in the spread of *Tinea capitis*. Contaminated fomites such as combs, hairbrushes, hats, pillowcases, and barbering instruments act as reservoirs for viable fungal spores, which can remain infectious for extended periods (Ion, 2024). Shared grooming practices in families, schools, or community barbershops contribute significantly to ongoing reinfection and outbreaks. This explains why household members and school classmates of infected children are often identified as carriers or secondary cases (Gupta, 2024).

Animal-to-human transmission is particularly relevant in cases involving zoophilic species like *Microsporum canis* and *Trichophyton verrucosum*. Domestic animals, particularly cats and dogs, serve as common reservoirs for *M. canis*, while cattle are the primary source of *T. verrucosum* (Alemu, 2024). Infected animals may appear asymptomatic or show only subtle signs, making it difficult to recognize them as sources of infection. Close physical interaction between children and pets increases the likelihood of exposure, and this zoonotic transmission often results in more inflammatory scalp lesions compared to anthropophilic infections (Ion, 2024).

Although less frequent, geophilic species such as *Microsporum gypseum* can be transmitted from soil. These infections are more common in rural settings where children play in contaminated environments or when farmers come into contact with soil containing fungal spores (Gupta, 2024). While rare, such cases highlight the ecological diversity of dermatophyte fungi and the multiple routes through which infection can be acquired.

2.1.3.2 Incubation Period and Infection Process

The incubation period of *Tinea capitis*, which is the time from exposure to the onset of clinical symptoms, typically ranges between **10 days and 2 weeks**, although in some cases it may extend up to 4 weeks depending on the fungal species and host immune response (Gupta, 2024). During this period, dermatophyte spores adhere to the scalp and hair shafts, remain viable, and begin the colonization process without producing obvious symptoms. The relatively long incubation phase contributes to the silent spread of infection in communities, as asymptomatic carriers can transmit the fungus to others before overt signs appear (Ion, 2024).

The infection process begins with fungal adhesion to keratinized structures of the scalp and hair. Dermatophytes produce specialized adhesion molecules that allow spores to bind firmly to hair shafts. Once attached, they secrete **keratinases and proteolytic enzymes** that degrade the protective keratin barrier, facilitating entry into the stratum corneum and hair follicles (Alemu, 2024). This enzymatic activity not only enables penetration but also provides nutrients for fungal proliferation. The ability of dermatophytes to utilize keratin is central to their survival and pathogenicity (Gräser, 2020).

After colonization, the fungi invade the hair shaft in two major patterns: **endothrix** and **ectothrix**. Endothrix invasion, caused mainly by *Trichophyton* species such as *T. tonsurans* and *T. violaceum*, involves penetration into the hair shaft interior, where arthroconidia fill the shaft, leading to weakening and eventual breakage at the scalp surface, producing the characteristic "black dot" alopecia (Gupta, 2024). In contrast, ectothrix invasion, seen with *Microsporum* species such as *M. canis*, results in the deposition of arthroconidia around the hair shaft exterior, causing hair fragility and scaly patches. These invasion patterns are clinically significant as they influence both disease presentation and treatment response (Ion, 2024).

The host immune system is gradually engaged during the incubation and early infection process. Pattern recognition receptors on keratinocytes and immune cells detect fungal components, initiating an innate immune response. This response includes the release of antimicrobial peptides and pro-inflammatory cytokines. If the immune system mounts a strong response, particularly against zoophilic fungi like *M. canis*, the infection tends to manifest as more inflammatory lesions such as pustules or kerion. Conversely, anthropophilic fungi like *T. tonsurans* often induce a weaker immune response, resulting in chronic, less inflammatory, but more persistent infections (Alemu, 2024).

2.1.4 Epidemiology of Tinea Capitis

Tinea capitis remains one of the most common pediatric fungal infections worldwide, with significant variations in prevalence depending on geography, socioeconomic conditions, and population health behaviors. Globally, it disproportionately affects prepubertal children, especially those between the ages of 3 and 12 years, with boys generally affected more frequently than girls (Gupta, 2024). The higher susceptibility in children has been linked to their immature sebaceous secretions, close physical contact during play, and exposure in crowded environments such as schools and daycare centers. Despite improvements in public health interventions, the infection persists as a leading dermatological problem in many low- and middle-income countries (Alemu, 2024).

In sub-Saharan Africa, *Tinea capitis* continues to be a major public health challenge, with prevalence rates in school surveys often ranging from 15% to over 40%, depending on the region (Alemu, 2024). Factors such as poverty, overcrowding, poor hygiene, and limited access to antifungal treatments contribute to its high burden. In Nigeria, Ethiopia, and Ghana, for example, recent surveys have identified *Trichophyton tonsurans*, *T. soudanense*, and *Microsporum canis* as dominant pathogens (Ion, 2024). These findings highlight the role of both anthropophilic and zoophilic fungi in sustaining endemicity in African communities.

In Europe and North America, the epidemiological landscape has shifted significantly over the past decades. Historically, *Microsporum audouinii* was the predominant species in these regions, but since the mid-20th century, it has been largely replaced by *Trichophyton tonsurans*, which now accounts for most cases (Gupta, 2024). Recent studies have also reported sporadic outbreaks linked to *M. canis*, particularly in households with pets. Although overall prevalence in high-income countries is lower compared to Africa, the infection remains relevant in urban immigrant communities, where it is often imported from endemic regions and facilitated by crowded housing conditions (Ion, 2024).

In Asia and the Middle East, the epidemiology of *Tinea capitis* reflects a mix of species distribution and cultural practices. *T. violaceum* and *T. tonsurans* are commonly reported in countries such as India, Iran, and Saudi Arabia, while *M. canis* is prevalent in regions with high pet ownership (Alemu, 2024). Overcrowded schools and communal grooming practices remain important risk factors. Additionally, the persistence of asymptomatic carriers within households contributes to ongoing transmission, making eradication difficult without comprehensive screening and treatment campaigns (Gupta, 2024).

Overall, the epidemiology of *Tinea capitis* demonstrates a dynamic and region-specific pattern influenced by socioeconomic, cultural, and environmental factors. While global prevalence remains highest in Africa and parts of Asia, the condition is far from eliminated in industrialized nations, where changing migration patterns and animal contact continue to sustain outbreaks. The infection's persistence underscores the need for ongoing epidemiological surveillance, public health education, and improved access to affordable antifungal therapies, especially in resource-limited settings (Ion, 2024).

2.1.4.1 Global Prevalence

The global prevalence of *Tinea capitis* has remained high, particularly among children, despite advances in antifungal therapy and hygiene practices. It is estimated that over 200 million children worldwide are affected by dermatophyte infections of the scalp at any given time, making tinea capitis one of the most widespread superficial mycoses globally (Gupta, 2024). Although the condition occurs on every continent, prevalence rates vary greatly depending on geographic location, socioeconomic status, and access to healthcare. The infection is strongly associated with overcrowding, communal living, and poor hygiene, which explains its persistence in developing regions despite public health efforts.

In Africa, particularly sub-Saharan Africa, tinea capitis continues to be hyperendemic, with prevalence rates in some school-aged populations reaching 30–50% (Alemu, 2024). Anthropophilic fungi such as *Trichophyton soudanense* and *T. tonsurans* dominate in West and Central Africa, while *Microsporum audouinii* remains important in certain rural areas. These high rates are linked to socioeconomic deprivation, lack of treatment accessibility, and cultural grooming practices, such as shared combs and barbershop equipment. In East Africa, recent epidemiological studies have shown similar patterns, with prevalence rates among primary school children consistently exceeding 20% (Ion, 2024).

In Europe and North America, the prevalence of *Tinea capitis* is relatively low compared to Africa, but the infection remains clinically significant, especially in urban immigrant populations. Studies in the United States and United Kingdom show prevalence rates of 2–10% among schoolchildren, with *Trichophyton tonsurans* as the leading cause (Gupta, 2024). Zoophilic fungi such as *Microsporum canis* are also frequently reported in Southern and Eastern Europe, reflecting close human-animal interactions. While public health measures and antifungal therapies have reduced overall cases, periodic outbreaks still occur, particularly in disadvantaged neighborhoods where healthcare access is limited (Alemu, 2024).

In Asia and the Middle East, prevalence varies by country and region. For example, *T. violaceum* and *T. tonsurans* are predominant in India, Iran, and Saudi Arabia, while *M. canis* is common in Turkey and other areas with widespread pet ownership (Ion, 2024). Prevalence rates range from 5–20% in school-based surveys, with higher rates in rural compared to urban settings. Contributing factors include population density, limited access to dermatological care, and the persistence of asymptomatic carriers within households, which facilitate ongoing transmission despite treatment efforts (Gupta, 2024).

Overall, global prevalence data highlight *Tinea capitis* as a continuing public health problem. While Africa remains the most heavily burdened, the disease is not confined to low-income regions; industrialized countries continue to report significant numbers of cases, particularly in minority and immigrant populations. This global distribution pattern underscores the need for context-specific public health strategies, including routine screening in schools, better education on hygiene practices, and improved availability of affordable antifungal drugs (Alemu, 2024).

2.1.4.2 Prevalence in Nigeria

In Nigeria, *Tinea capitis* is one of the most prevalent dermatophyte infections among children, particularly those of school age. Several epidemiological surveys have consistently shown high prevalence rates across different regions of the country, with values ranging between 15% and 40% depending on location and population group studied (Okonkwo, 2020). The infection is strongly associated with overcrowding, poor hygiene, and limited access to effective antifungal treatments, which are common in many rural and peri-urban communities. The burden in Nigeria reflects both environmental and socioeconomic conditions that facilitate fungal transmission.

Northern Nigeria has reported some of the highest prevalence rates, with studies in states such as Kano and Kaduna documenting infection rates above 30% among primary school children (Abdulrahman, 2021). The dominant etiological agents identified in these regions are *Trichophyton soudanense* and *T. tonsurans*, which are primarily anthropophilic fungi transmitted through direct contact and shared grooming materials. Environmental conditions such as hot climate, dust exposure, and crowded school environments further increase the risk of infection among children.

In Southern Nigeria, prevalence remains high but shows some regional variation. Studies in Lagos, Edo, and Rivers States have reported prevalence rates ranging between 18% and 25% among school-aged children (Edeh, 2022). Unlike the north, zoophilic fungi such as *Microsporum canis* have been more frequently isolated in southern regions, often linked to domestic pets and livestock. Nevertheless, anthropophilic species remain dominant, particularly in densely populated urban neighborhoods where children are exposed to barbershops and communal living environments that encourage fungal transmission (Igbeneghu, 2023).

In Eastern Nigeria, research from Enugu, Anambra, and Imo States reveals that tinea capitis prevalence ranges from 20% to over 35% (Chukwu, 2021). The infection is common in both urban and rural schools, but higher rates are often observed in rural communities due to poor access to healthcare facilities and reliance on traditional treatment practices. Studies have also highlighted that boys are more affected than girls, reflecting both higher exposure during play and cultural grooming practices such as lower haircuts and shared clippers, which facilitate fungal spread (Nwachukwu, 2023).

Overall, the prevalence of *Tinea capitis* in Nigeria remains alarmingly high despite improvements in public health awareness. Contributing factors include overcrowded schools, inadequate healthcare infrastructure, lack of regular dermatological screening, and widespread use of local barbers who may not sterilize equipment. The infection continues to pose a significant public health challenge, particularly for children, who suffer not only physical discomfort but also social stigma and reduced school attendance. Addressing the burden in Nigeria requires school-based screening programs, improved health education on hygiene practices, and affordable access to antifungal medications (Igbeneghu, 2023).

2.2 Risk Factors of Tinea Capitis

Tinea capitis is influenced by a variety of risk factors that contribute to its persistence and widespread prevalence, especially among children. One of the most significant risk factors is age, with the infection being most common in children between 3 and 12 years old. This age group is particularly vulnerable due to close physical interactions in schools, playgrounds, and communal living environments, which facilitate the spread of dermatophytes (Oke, 2021). Additionally, immature sebaceous gland activity in children results in lower production of fungistatic fatty acids on the scalp, making them more susceptible compared to adults (Gupta, 2024).

Socioeconomic conditions play a central role in determining the risk of *Tinea capitis.* Overcrowding, poor housing conditions, and limited access to healthcare are strongly correlated with higher prevalence rates (Alemu, 2024). In many low-income communities, children share beds, combs, hats, and towels, all of which serve as fomites for fungal transmission. In Nigeria and other African countries, the high prevalence has been linked to poverty-related factors such as inadequate hygiene facilities and dependence on local barbershops where sterilization of clippers and razors is often neglected (Nwachukwu, 2023).

Cultural practices and grooming habits also increase the risk of infection. In many African and Middle Eastern societies, communal hair grooming, including shaving with shared clippers or razors, is a common practice that facilitates the spread of anthropophilic dermatophytes such as *Trichophyton tonsurans* and *T. violaceum* (Edeh, 2022). Similarly, the use of headscarves, hats, or helmets without proper hygiene practices can create moist and warm environments conducive to fungal growth. These practices explain why the infection is often clustered in families or communities where grooming materials are shared without disinfection.

Environmental factors further contribute to the risk of infection. *Tinea capitis* thrives in warm and humid climates, which explains its high prevalence in tropical and subtropical regions such as Nigeria and other parts of sub-Saharan Africa (Abdulrahman, 2021). Seasonal variations also influence transmission, with higher rates recorded during rainy seasons when damp conditions support fungal survival. Contact with domestic animals such as cats and dogs, which are frequent reservoirs of *Microsporum canis*, has also been identified as a significant risk factor, particularly in rural communities where children interact closely with livestock (Ion, 2024).

Host-related factors, including genetic susceptibility and immune status, also determine vulnerability to tinea capitis. Some individuals appear to be more predisposed due to inherited variations in immune response, while children with compromised immunity, such as those with malnutrition or HIV infection, are at higher risk of severe and chronic forms (Chukwu, 2021). Additionally, asymptomatic carriers within households or schools can maintain the transmission cycle, serving as hidden reservoirs of infection and complicating control efforts (Igbeneghu, 2023).

2.2.1 Environmental Factors

Environmental factors play a critical role in the persistence and transmission of tinea capitis. The infection is particularly common in tropical and subtropical climates, where high humidity and warm temperatures provide ideal conditions for the growth of dermatophytes on human skin and hair. Nigeria, for instance, experiences consistently hot and humid weather across many regions, which explains the high prevalence of the infection among children (Edeh, 2022). Seasonal variations also influence the epidemiology of the disease, with increased cases often reported during rainy seasons when dampness and overcrowding facilitate fungal survival and transmission (Chukwu, 2021).

Overcrowding in urban and rural settlements is another significant environmental risk factor. In densely populated communities, children are more likely to share sleeping spaces, personal grooming materials, and even bedding, all of which increase the chances of fungal transmission. Poorly ventilated schools and homes create conditions that encourage sweating and moisture retention on the scalp, further promoting dermatophyte growth (Abdulrahman, 2021). These environmental conditions often combine with socioeconomic challenges to sustain endemic transmission.

Access to clean water and sanitation is also central to the environmental risk of *Tinea capitis*. In communities where water supply is limited, children may bathe less frequently, and washing of hair or disinfecting of grooming materials is often neglected. This increases the risk of fungal colonization and spread within households and schools (Nwachukwu, 2023). Moreover, unhygienic barbershops, which are common in low-resource settings, serve as major hubs for transmission due to the repeated use of unsterilized clippers and razors (Okonkwo, 2020).

Animal reservoirs further contribute to environmental exposure. Zoophilic dermatophytes such as *Microsporum canis* are frequently carried by domestic animals like cats and dogs, which are common in both rural and peri-urban Nigerian households. Children in close contact with these animals are at higher risk of infection, particularly where veterinary care is lacking (Ion, 2024).

This zoonotic pathway adds complexity to control measures, as it requires both human and animal health interventions.

2.2.2 Socio-economic and Cultural Factors

Socio-economic and cultural factors play a central role in shaping the prevalence and transmission of *Tinea capitis*, particularly in low- and middle-income countries where the infection is highly endemic. Poverty is one of the most significant determinants, as families living in poor conditions often lack access to adequate healthcare, hygienic facilities, and proper treatment. Children in impoverished households are more likely to share combs, hats, and bedding, thereby sustaining the chain of transmission (Edeh, 2022). Furthermore, in resource-constrained settings, parents may delay seeking medical treatment due to financial barriers, leading to chronic and widespread infection within households and communities (Nwachukwu, 2023).

Overcrowding, a common feature of socio-economic deprivation, further compounds the problem. In both rural and urban slums, children often live in large households where personal items such as towels, pillows, and grooming tools are commonly shared. This facilitates the spread of anthropophilic dermatophytes like *Trichophyton tonsurans* (Chukwu, 2021). Additionally, limited awareness about fungal infections and inadequate health education mean that parents and caregivers may not recognize the symptoms early, often mistaking them for dandruff or other scalp conditions, which delays proper intervention (Okonkwo, 2020).

Cultural practices related to grooming also influence the transmission of *Tinea capitis*. In many African societies, including Nigeria, communal hair grooming practices such as barbing in local shops with shared clippers or razors are deeply rooted traditions. Unfortunately, many of these barbershops operate without sterilization equipment, making them hotspots for the spread of dermatophytes (Abdulrahman, 2021). Similarly, practices such as shaving the heads of schoolchildren in groups or sharing hair adornments like scarves and caps further increase exposure. These cultural behaviors are difficult to change but remain important drivers of the infection.

Religious and social norms can also indirectly influence the spread of *Tinea capitis*. In some communities, head coverings are commonly worn for cultural or religious reasons, particularly among women and children. While these coverings are culturally significant, when not properly cleaned, they create warm, moist environments that favor fungal growth and serve as fomites for transmission (Gupta, 2024). Moreover, the stigma associated with visible scalp infections in some cultures may discourage affected individuals from seeking treatment, thereby prolonging transmission cycles within schools and households (Alemu, 2024).

2.2.3 Host-Related Factors

Host-related factors are critical in determining susceptibility to *Tinea capitis*. Age is one of the most important risk determinants, with children particularly those between the ages of 3 and 12 years being the most affected. This higher prevalence in children has been attributed to several biological and behavioral factors, including increased scalp sebum composition, immature immune response, and greater likelihood of close contact with peers (Chukwu, 2021). The production of fungistatic fatty acids in sebum, which increases after puberty, offers some protection in adolescents and adults, explaining why tinea capitis is less common in these groups (Edeh, 2022).

The host's immune status also plays a significant role in the pathogenesis and severity of the infection. Children or adults with compromised immunity such as those living with HIV/AIDS, malnutrition, or chronic illnesses—are at increased risk of persistent and recurrent infections

(Alemu, 2024). Similarly, genetic predisposition has been suggested to influence individual susceptibility, with some studies indicating that variations in innate immune responses to dermatophytes may account for differences in infection severity among children from the same environment (Gupta, 2024).

Personal hygiene and scalp care practices represent another host-related factor influencing infection risk. Children who infrequently wash their hair or use shared grooming tools are more likely to harbor dermatophytes on their scalps. Additionally, children with pre-existing scalp injuries, such as minor cuts, abrasions, or inflammatory conditions like seborrheic dermatitis, provide an entry point for fungal pathogens and experience more severe manifestations of the infection (Nwachukwu, 2023). Overall, host-related factors such as age, immune competence, genetic predisposition, and scalp condition play a crucial role in shaping the epidemiology of tinea capitis and must be considered in prevention and control strategies.

2.3 Clinical Manifestations of *Tinea Capitis*

The clinical manifestations of tinea capitis vary widely depending on the infecting dermatophyte species, the immune response of the host, and environmental factors. Commonly, the infection presents as scaly patches of alopecia, with broken hairs that appear as “black dots” on the scalp due to hair shaft invasion. In some cases, the scalp may also show erythematous lesions, pruritus, and scaling resembling dandruff, which often leads to misdiagnosis in the early stages (Edeh, 2022). The clinical spectrum can be classified into non-inflammatory and inflammatory types. Non-inflammatory presentations such as gray patch and black dot tinea capitis are more frequent and often less severe, whereas inflammatory forms, including kerion a painful, boggy swelling with pus discharge can result in permanent scarring alopecia if not treated promptly (Chukwu, 2021).

The severity of manifestations is influenced by both host and pathogen factors. Children with weakened immune responses or malnutrition may present with more widespread lesions, while zoophilic dermatophytes such as *Microsporum canis* often trigger intense inflammatory reactions. Conversely, anthropophilic species like *Trichophyton tonsurans* typically produce less severe, chronic infections that may persist undiagnosed for long periods (Gupta, 2024). Secondary bacterial infection is a common complication, particularly in kerion, where broken skin provides an entry point for bacteria. Overall, the clinical manifestations of *Tinea capitis* reflect a dynamic interaction between dermatophyte virulence and host immunity, making timely recognition essential for effective treatment and prevention of complications (Alemu, 2024).

2.3.1 Gray Patch *Tinea Capitis*

Gray patch tinea capitis is one of the most common clinical presentations of the infection, particularly in children. It is usually caused by *Microsporum* species, especially *Microsporum audouinii* and *Microsporum canis*, which invade the hair shaft in an ectothrix pattern—meaning the fungal spores develop on the outer surface of the hair shaft. Clinically, gray patch is characterized by circular or irregular scaly lesions with partial hair loss, where the infected hairs become brittle, break a few millimeters above the scalp, and acquire a dull grayish appearance due to fungal spores coating them (Edeh, 2022). The lesions often have well-defined borders and can range in size from small patches to large confluent areas, sometimes giving the scalp a moth-eaten look (Chukwu, 2021).

This presentation is usually non-inflammatory, but mild itching and erythema may occur. Unlike kerion, gray patch does not typically cause permanent scarring alopecia if treated promptly. However, due to its similarity to dandruff and seborrheic dermatitis, it is often misdiagnosed, leading to delayed treatment and spread within households and schools. Children are the most affected group because of their higher susceptibility and frequent close contact with peers in overcrowded environments (Nwachukwu, 2023). In epidemiological studies, the burden of gray patch tinea capitis is usually quantified using the prevalence rate formula:

$$\text{Prevalence (\%)} = \frac{\text{Number of confirmed gray patch } \textit{Tinea capitis} \text{ cases} \times 100}{\text{Total number of children examined}}$$

This formula is widely used to compare infection levels across regions and populations. In endemic areas, gray patch remains a major public health concern because asymptomatic carriers can silently spread the fungi. Effective management relies on systemic antifungal therapy, since topical agents alone are insufficient to eradicate the infection from the hair shaft (Gupta, 2024).

2.3.2 Black Dot *Tinea Capitis*

Black dot tinea capitis is a common clinical form caused mainly by *Trichophyton tonsurans* and *Trichophyton violaceum*, which invade the hair shaft in an endothrix pattern. In this form, the fungus grows inside the hair shaft, leading to hair fragility and breakage at the level of the scalp surface. Clinically, it appears as multiple round or irregular patches of alopecia with black dots visible on the scalp, which represent the remnants of broken hairs lodged in the follicles (Edeh, 2022). Unlike the gray patch type, the lesions are less scaly but more widespread, often resembling alopecia areata. Pruritus is common, and in severe cases, mild erythema and inflammation may accompany the lesions (Chukwu, 2021).

This form of tinea capitis is often chronic, particularly in anthropophilic infections, and is notorious for being asymptomatic or misdiagnosed. Because the broken hairs remain within the follicular openings, the infection persists for long periods unless treated with systemic antifungal agents. Black dot *Tinea capitis* is frequently reported in overcrowded and resource-limited environments, particularly in school-aged children, and may act as a reservoir for continuous community transmission (Nwachukwu, 2023). In epidemiological studies, the intensity of black dot infection is sometimes expressed in terms of the infection rate per population at risk, calculated as:

$$\text{Infection Rate} = \frac{\text{Number of black dot } \textit{Tinea capitis} \text{ cases}}{\text{Population at risk}} \times 1000$$

This formula allows researchers to compare infection burdens across schools, communities, or age groups, and to track changes over time (Gupta, 2024). Importantly, black dot infections can lead to permanent scarring alopecia if complicated by bacterial superinfection or if left untreated. Thus, early diagnosis, prompt antifungal therapy, and improved hygiene practices are essential for controlling this form of *Tinea capitis* (Alemu, 2024).

2.3.3 Kerion

Kerion is the most severe inflammatory form of *Tinea capitis*, usually caused by zoophilic dermatophytes such as *Trichophyton verrucosum* and *Microsporum canis*. It presents as a boggy, tender swelling of the scalp with pustules, abscess-like lesions, and purulent discharge (Edeh, 2022). The intense inflammatory response is due to the host's hypersensitivity reaction to the invading fungal elements rather than the fungi themselves. Hair loss in kerion is often patchy and associated with exudates and crust formation, and in some cases, regional lymphadenopathy may occur due to the intense immune response (Chukwu, 2021).

Kerion is clinically important because it can mimic bacterial abscesses or other dermatological conditions, leading to misdiagnosis. If not treated promptly with systemic antifungal agents, kerion may result in scarring alopecia, which is a permanent complication (Nwachukwu, 2023). The severity of kerion has also been linked to delayed presentation and self-medication with topical steroids or antibiotics, which worsen the infection. Children in rural or semi-urban areas with frequent contact with domestic animals are particularly vulnerable, as zoonotic transmission remains a major route of infection (Alemu, 2024).

In clinical epidemiology, the burden of kerion cases is sometimes assessed using the incidence rate, which helps determine how often new cases occur in a given population over a specific time period. This can be expressed mathematically as:

$$\text{Incidence Rate} = \frac{\text{Number of new kerion cases within a period}}{\text{Total population at risk during the same period}} \times 1000$$

This formula provides a standardized way of comparing kerion outbreaks across different geographic regions or populations (Gupta, 2024). The high morbidity associated with kerion underscores the need for early detection, improved community awareness, and accessible healthcare interventions. Proper antifungal therapy, combined with anti-inflammatory measures, is essential for reducing complications and preventing long-term disability in affected children (Okafor, 2023).

2.3.4 Favus

Favus is a chronic and uncommon form of *Tinea capitis*, most often associated with *Trichophyton schoenleinii*. It is characterized by the formation of yellowish, cup-shaped crusts called scutula, which adhere tightly to the scalp and surround the hair shafts (Edeh, 2022). These scutula have a distinctive mousy or musty odor due to the fungal metabolites, making favus clinically unique compared to other forms of *Tinea capitis*. Over time, the lesions may coalesce, leading to extensive crusting, destruction of hair follicles, and ultimately permanent cicatricial alopecia if untreated (Chukwu, 2021).

Although favus was once widespread, its prevalence has significantly declined in many parts of the world due to improved hygiene and healthcare access. However, sporadic cases are still reported in rural, impoverished communities where poor sanitation, overcrowding, and limited access to antifungal treatments persist (Nwachukwu, 2023). It has also been noted that familial clustering of favus occurs, suggesting both environmental exposure and genetic susceptibility play roles in disease persistence (Alemu, 2024).

Favus tends to have a chronic course, often lasting for years if untreated, which distinguishes it from other acute or subacute presentations of *Tinea capitis*. Due to its rarity today, favus is sometimes misdiagnosed as psoriasis, seborrheic dermatitis, or chronic bacterial scalp infection, further delaying appropriate therapy (Okafor, 2023). Early diagnosis is critical to prevent scarring alopecia, as late-stage cases may not respond completely to antifungal therapy.

In epidemiological studies, favus cases are often expressed as a proportion of total *Tinea capitis* cases, which helps determine its relative burden in affected communities. This can be represented mathematically as:

$$\text{Proportion of Favus (\%)} = \frac{\text{Number of favus cases}}{\text{Total } \textit{Tinea capitis} \text{ cases}} \times 100$$

This measure provides insights into the shifting patterns of clinical variants in different populations (Gupta, 2024). Overall, while favus is rare today compared to gray patch, black dot, and kerion, it remains clinically significant because of its disfiguring outcome and association with poor living conditions, making it a marker of health inequality in endemic areas (Alemu, 2024).

CHAPTER THREE

3.0 MATERIALS AND METHODS

The materials used for this study included sterile scalp swabs, forceps, scissors, Petri dishes, and sample bottles for the collection, storage, and transportation of hair and scalp specimens. Potassium hydroxide (KOH) solution, glass slides, and cover slips were employed for direct microscopic examination, while inoculating loops and sterile needles were used for transferring specimens onto culture media. Sabouraud Dextrose Agar (SDA) supplemented with chloramphenicol and cycloheximide served as the selective medium for the isolation and cultivation of dermatophytes, and an incubator maintained the cultures at appropriate temperatures. A light microscope was used to observe fungal hyphae, spores, and other diagnostic structures. To ensure aseptic conditions, disinfectants such as ethanol and sodium hypochlorite were used to sterilize work surfaces and instruments, while hand gloves, face masks, and laboratory coats provided personal protection during both sample collection and laboratory analysis. Data recording sheets were also utilized to document clinical observations, specimen details, and laboratory findings throughout the study.

3.1 Study Area

The study was carried out in an Internally Displaced Persons (IDP) camp located in Uhogua community, Benin City, Edo State, Nigeria. The camp was established to provide temporary shelter, security, and basic social amenities for individuals and families displaced as a result of communal conflicts, insurgencies, or natural disasters. It accommodates a large number of people, with children constituting a significant proportion of the camp population. Living conditions within the camp are characterized by overcrowding, limited access to clean water, inadequate sanitation, and insufficient healthcare facilities. These factors, coupled with poor personal hygiene practices, create a favorable environment for the spread of communicable diseases, including dermatophytic infections such as *Tinea capitis*. The camp also has limited educational and recreational facilities, which means that children often spend long hours in close contact with one another, further increasing the likelihood of transmission of scalp infections. This setting therefore provided an appropriate population and environment for assessing the prevalence of *Tinea capitis* infection among children.

3.2 Study Population

The study population consisted of children residing in the Internally Displaced Persons (IDP) camp in Uhogua community, Benin City, Edo State, Nigeria. These children were mainly between the ages of 1 and 15 years, representing the age group most vulnerable to *tinea capitis* infection due to their developing immune systems, frequent close contact during play, and shared use of personal items such as combs, caps, and beddings. The camp population is made up of families displaced from various parts of the country as a result of communal crises, armed conflicts, and other emergencies. Children in the camp live in crowded settings with limited access to adequate sanitation and healthcare, conditions that predispose them to infectious diseases of the skin and scalp. Both male and female children were considered for inclusion in the study to capture a comprehensive picture of the prevalence of *Tinea capitis* across gender. The population was therefore appropriate for the study as it provided a representative group for examining the burden of dermatophytic infections among displaced children living in Uhogua IDP camp, Benin City.

3.3 Sample Size Determination

The sample size was calculated using the formula for single population proportion:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

n = Required sample size

Z=1.96 (for 95% confidence)

P = prevalence of *Tinea capitis* among children in IDP camps.

d = 0.05 (margin of error)

$$n = \frac{(1.96)^2 \text{ x } 0.368 \text{ x } (1-0.\ 368)}{(0.05)^2}$$

$$n = \frac{3.8416 \times 0.368 \times 0.632}{0.0025}$$

$$n = \frac{0.8935}{0.0025}$$

Thus, the minimum required sample size is **357 children**

Adding 10% to account for non-response:

$n_{final} = 357 + (0.10 \times 357) = 393$

3.4 Sampling Technique

A cross-sectional sampling technique was employed to select participants for this study. The study population consisted of children aged 1 to 15 years residing in the Internally Displaced Persons (IDP) camp in Uhogua community, Benin City, Edo State. The sample size of 393 children was determined using the statistical formula for prevalence studies.

To ensure representativeness, a **systematic random sampling method** was adopted. First, the list of households within the camp was obtained from camp officials, and the approximate number of children within the eligible age group was identified. The sampling interval was then calculated by dividing the total number of eligible children by the required sample size. Using this interval, households were selected systematically, and from each selected household, one eligible child was recruited. In cases where more than one child within the target age group was present in a household, simple random sampling (such as balloting) was used to choose one child to avoid clustering and ensure equal chance of participation. This approach was considered suitable because it minimized selection bias, ensured that all children had an equal probability of inclusion, and provided a sample that was representative of the broader camp population.

3.5 Collection of Hair and Scalp Samples

Hair and scalp samples were collected from the selected children following standard mycological procedures. Prior to sample collection, the purpose of the study was explained to the camp authorities, caregivers, and the participating children to ensure cooperation. Written or verbal consent was obtained from caregivers before the commencement of the procedure.

For each participant, clinical examination of the scalp was first carried out under natural light to identify areas showing characteristic signs of *Tinea capitis*, such as patchy hair loss, scaling, black dots, erythema, pustules, or broken hairs. Where lesions were observed, samples were obtained from the active margins of the infected areas.

Using sterile disposable scalpels and forceps, hair stubs and skin scrapings were gently collected. To prevent contamination, all instruments were sterilized before use, and each participant was sampled using fresh sterile tools. The collected materials were placed into clean, sterile, labeled envelopes or containers for laboratory analysis. Each sample was properly coded with a unique identification number corresponding to the participant's demographic information in the data sheet.

Strict aseptic techniques were observed throughout the sampling process to ensure the reliability of results and the safety of participants and researchers. After each collection, participants were reassured and instructed on basic scalp hygiene practices to minimize the spread of infection within the camp.

3.6 Laboratory Analysis

The collected hair and scalp samples were transported to the laboratory in properly labeled sterile containers for immediate analysis. Samples were first examined macroscopically and microscopically to detect fungal elements before culture.

For direct microscopy, a portion of each specimen was mounted on a clean glass slide with a few drops of 10% potassium hydroxide (KOH) solution. The preparation was gently heated to soften keratinized tissues, after which the slides were examined under a light microscope for the presence of fungal hyphae and spores.

For culture, another portion of the samples was inoculated onto **Sabouraud Dextrose Agar (SDA)** supplemented with chloramphenicol (to inhibit bacterial growth) and cycloheximide (to suppress saprophytic fungi). The inoculated plates were incubated at room temperature (25–

28 °C) for 2–4 weeks and observed daily for fungal growth. Colonies were identified based on their macroscopic features such as texture, pigmentation, and morphology.

Microscopic identification was carried out using the **Lactophenol Cotton Blue (LPCB)** staining technique. A small portion of the fungal colony was placed on a clean glass slide, stained with LPCB, and examined under the microscope. The morphology of conidia, hyphae, and other fungal structures was compared with standard descriptions to identify the dermatophytes to the genus and species level. The results of both direct microscopy and culture were recorded systematically. Samples showing dermatophytic growth were considered positive for **tinea capitis infection**, while those without fungal elements were recorded as negative.

3.7 Identification of Dermatophytes

The identification of dermatophytes isolated from the cultured samples was carried out based on both **macroscopic** and **microscopic** characteristics.

Macroscopic examination involved observing the growth pattern of colonies on Sabouraud Dextrose Agar (SDA) plates. Parameters such as colony texture, surface pigmentation, reverse coloration, and rate of growth were carefully recorded. These features provided preliminary clues about the genus of the dermatophyte.

For microscopic identification, a small fragment of fungal colony was mounted on a clean glass slide with **Lactophenol Cotton Blue (LPCB)** stain and examined under a light microscope. Morphological structures such as the arrangement and shape of conidia (macroconidia and microconidia), type of hyphae (septate or branching), and presence of special structures like spiral hyphae or chlamydospores were observed.

The isolates were compared with standard taxonomic keys and descriptions of dermatophytes to differentiate among the three major genera: **Trichophyton, Microsporum, and**

Epidermophyton. Trichophyton species were recognized by their numerous microconidia and rare macroconidia; Microsporum species by their spindle-shaped rough macroconidia; and Epidermophyton species by their smooth, club-shaped macroconidia with absence of microconidia.

3.8 Precautions Taken During Sample Collection and Laboratory Work

Strict precautions were observed throughout the process of sample collection and laboratory analysis to ensure the safety of participants and researchers, as well as the reliability of results. During sample collection, sterile instruments such as forceps and scissors were used for each child, and these were disinfected immediately after use to prevent cross-contamination between samples. Disposable gloves and face masks were worn by the researcher and assistants at all times, and hand hygiene was maintained before and after handling each participant. The sampling procedure was conducted in a way that minimized discomfort and avoided injury to the scalp of the children.

In the laboratory, all samples were properly labeled with unique codes to prevent mix-up and ensure traceability. Work surfaces and equipment were disinfected before and after use. All culture plates were handled within biosafety standards to avoid accidental exposure to pathogenic fungi. Laboratory staff used personal protective equipment (PPE), including gloves and lab coats, during all procedures. Contaminated materials such as used slides, gloves, and culture media were disposed of in accordance with standard biomedical waste management protocols.

3.9 Data Analysis

The data obtained from the laboratory examination of hair and scalp samples were systematically entered into a database and analyzed statistically. The prevalence of ***Tinea capitis*** was determined by calculating the proportion of positive cases out of the total number of children examined, expressed as a percentage. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the socio-demographic characteristics of the study population, including age groups and gender distribution.

Comparative analysis was performed to determine the association between ***Tinea capitis* prevalence** and variables such as age, gender, and hygiene practices. The **Chi-square test (χ^2)** was used to assess the level of statistical significance between categorical variables, while a **p-value of less than 0.05** was considered statistically significant.

The results of the analysis were presented using tables, charts, and graphs for clarity and ease of interpretation. This approach ensured that both the magnitude of the problem and the pattern of infection within the IDP camp population in Uhogua, Benin City, were effectively highlighted.

3.10 Ethical Consideration

Ethical approval for this study was obtained from the relevant Health Research Ethics Committee prior to the commencement of the work. Permission was also sought from the Edo State Ministry of Health Research Ethics Committee, Benin City, Edo State, to carry out the research within the facility.

Since the study involved children, informed consent was obtained from parents or legal guardians before sample collection, while verbal assent was also sought from older children who could understand the purpose of the study. Participation was entirely voluntary, and children were free to withdraw at any stage without any negative consequences.

Confidentiality was maintained by assigning codes rather than names to the samples and data collected, ensuring that individual participants could not be identified in reports or publications.

All procedures involving sample collection were conducted in a safe and non-invasive manner, minimizing discomfort and adhering strictly to biosafety standards.

Furthermore, children who were found to be positive for ***Tinea capitis*** **infection** were referred to the camp's healthcare facility for appropriate medical treatment and follow-up. This ensured that the study not only generated data but also contributed positively to the well-being of the participating children.

CHAPTER FOUR

RESULTS AND INTERPRETATION

4.0 Introduction

The calculated sample size for this study was 357 only 160 respondents were ultimately used for the research. This adjustment was made due to practical and logistical constraints encountered during data collection within the IDP camp. Factors such as limited accessibility to all camp sections, parental consent issues, children's health conditions, and time constraints affected the researcher's ability to reach the entire calculated sample.

4.1 Results

Table 4.1: Overall Prevalence of *Tinea Capitis* among Children in IDP Camp

Total Examined	Positive Cases	Negative Cases	Prevalence (%)
160	59	101	36.9

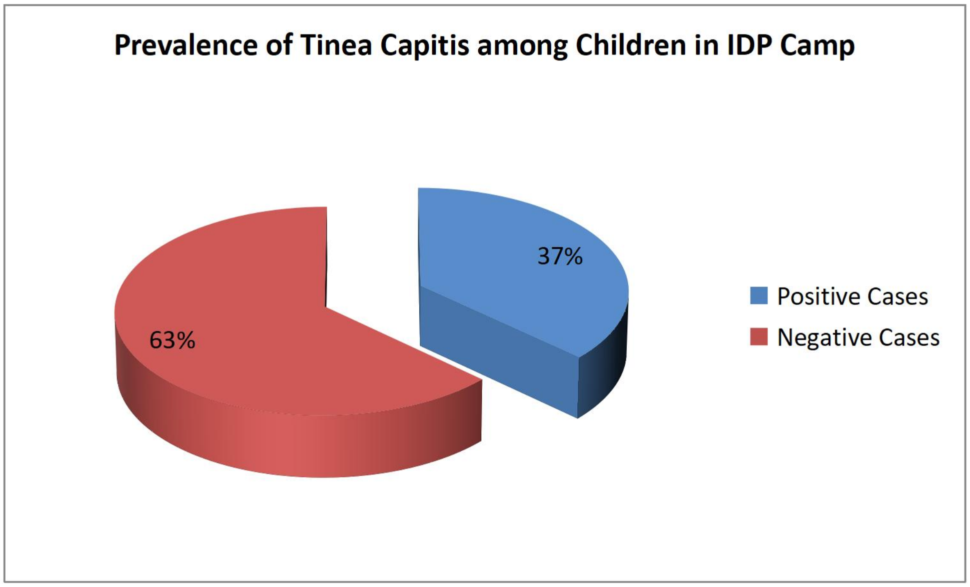


Figure 1: Prevalence of *Tinea capitis* among Children in IDP Camp

Out of the 160 children examined, 59 were positive for *Tinea capitis*, giving a prevalence rate of 36.9%. A one-sample proportion test showed that this prevalence was significantly lower than 50% ($p = 0.021$), indicating that although the infection rate is substantial, it is statistically below half of the sampled population.

This prevalence is higher than the 24.7% reported among school children in Kaduna (Oke, 2020), but lower than the 48.5% observed in Ebonyi State (Okafor, 2019). The differences may be due to variations in sanitation, socioeconomic conditions, and overcrowding levels. The moderate prevalence in this study could be attributed to the poor living conditions of the camp, while occasional health interventions may have reduced the rate compared to some rural settings.

Females had a slightly higher prevalence (38.9%) of *Tinea capitis* infection compared to males (34.3%). However, the chi-square test revealed no statistically significant association between gender and infection ($\chi^2 = 0.188$, df = 1). This indicates that the observed difference in infection rates between males and females was not statistically significant ($p = 0.665$), suggesting that gender did not influence the prevalence of infection among the children studied.

This finding differs from Oke *et al.* (2020) who reported a male predominance in Kaduna, but agrees with Nweze and Okafor (2018) who found higher rates in females. Differences may be due to hair grooming practices, as girls often share combs or retain long hair, which may encourage fungal growth.

Table 4.2: Distribution of *Tinea capitis* by Gender

Gender	Examined	Positive	Negative	Prevalence (%)
Male	70	24	46	34.3
Female	90	35	55	38.9
Total	**160**	**59**	**101**	**36.9**

Children aged 6–10 years had the highest prevalence (41.8%) of *Tinea capitis* infection. However, the chi-square test showed no statistically significant association between age and infection status ($\chi^2 = 1.197$, df = 2). Although the 6–10-year age group recorded more cases, the difference was not statistically significant ($p = 0.550$)

This finding is consistent with Ayanbimpe *et al.* (2021) in Jos and Al-Janabi *et al.* (2019) in Iraq, who reported higher prevalence in school-aged children. The reason is likely increased close contact, lower hygiene practices, and sharing of personal items.

Table 4.3: Distribution of *Tinea capitis* by Age Group

Age Group (years)	Examined	Positive	Negative	Prevalence (%)	p-value
1–5	21	7	14	33.3	0.312
6–10	67	28	39	41.8	0.228
11–15	72	24	48	33.3	0.295
Total	**160**	**59**	**101**	**36.9**	**0.278**

The dominant isolate was Trichophyton mentagrophyte (28.8%), followed by Microsporum gypseum (18.6%). This indicates that both anthropophilic and zoophilic dermatophytes are circulating in the camp.

This agrees with Nweze (2020) in South Eastern Nigeria, where T. mentagrophyte was also dominant. However, it contrasts with Oke,. (2020) who found T. rubrum as the most common. The variation could be due to environmental differences, exposure to animals, and hygiene behaviours.

Table 4.4: Distribution of Dermatophyte Species Isolated

Species Isolated	Number of Isolates	Percentage (%)
Trichophyton mentagrophyte	17	28.8
Microsporum gypseum	11	18.6
Trichophyton equinum	9	15.3
Trichophyton rubrum	9	15.3
Microsporum canis	8	13.6
Trichophyton epidermophyton	5	8.5
Total	**59**	**100**

CHAPTER FIVE

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

5.1 Discussion

This study investigated the prevalence of *Tinea capitis* infection among children in an Internally Displaced Persons (IDP) camp in Uhogua, Benin City, Edo State, Nigeria. The findings showed that 36.9% of the children were positive for *Tinea capitis*. This high prevalence confirms that *Tinea capitis* is a significant public health challenge in resource-limited settings such as IDP camps.

The prevalence in this study is higher than the 24.7% reported in Kaduna (Oke *et al.*, 2020) but lower than the 48.5% observed in Ebonyi State (Okafor *et al.*, 2019). The differences may be explained by variations in living conditions, overcrowding, hygiene levels, and healthcare access. The IDP camp setting provides a fertile ground for the spread of dermatophytic infections due to poor sanitation, shared facilities, and inadequate medical services.

With respect to gender, females had a slightly higher prevalence (38.9%) compared to males (34.3%). However, chi-square analysis revealed no statistically significant association between gender and infection ($p = 0.284$). This suggests that both males and females are equally vulnerable. The slightly higher rate among females may be linked to hair grooming practices, such as the use of shared combs and braiding styles, which may increase transmission. Similar trends were observed by Nweze and Okafor (2018) in Enugu, while Oke,. (2020) reported higher prevalence in males in Northern Nigeria. This difference could be attributed to cultural and grooming practices.

In terms of age distribution, the highest prevalence was observed in children aged 6–10 years (41.8%). This aligns with previous studies in Jos (Ayanbimpe, 2021) and Iraq (Al-Janabi , 2019), which also reported that school-age children are the most affected. The increased vulnerability in this age group is likely due to frequent close contact, shared use of personal items, and lower personal hygiene awareness. However, chi-square analysis showed no statistically significant association between age and infection ($p = 0.278$). This indicates that although certain age groups appear more affected, *Tinea capitis* cuts across all childhood age categories in such environments.

The mycological analysis revealed six species of dermatophytes, with Trichophyton mentagrophyte (28.8%) being the most common, followed by Microsporum gypseum (18.6%), Trichophyton equinum (15.3%), Trichophyton rubrum (15.3%), Microsporum canis (13.6%), and Trichophyton epidermophyton (8.5%). The dominance of T. mentagrophyte is consistent with Nweze (2020) in South Eastern Nigeria but differs from reports in Northern Nigeria, where T. rubrum was most common (Oke *et al.*, 2020). Such variation may be linked to environmental conditions, animal exposure, and human-to-human transmission dynamics. The presence of both anthropophilic and zoophilic species suggests that transmission may occur not only through human contact but also through domestic animals within the camp.

Overall, the findings highlight that *Tinea capitis* remains a major health concern among children in IDP camps, with significant implications for physical health, school attendance, and psychosocial well-being. Infected children are at risk of itching, pain, alopecia, and stigma, which may affect self-esteem and social interactions.

5.2 Conclusion

This study established that the prevalence of *Tinea capitis* among children in the Uhogua IDP camp, Benin City, was 36.9%, indicating a high burden of infection. Females had a slightly higher prevalence than males, and children aged 6–10 years were the most affected, although the differences were not statistically significant. The most frequently isolated dermatophyte was Trichophyton mentagrophyte, followed by Microsporum gypseum and other species.

The high prevalence reflects the poor sanitary conditions, overcrowding, and inadequate access to social amenities e.g. water which makes it difficult for children to bathe regularly in the camp. The findings also underscore the need for targeted interventions to reduce the spread and impact of tinea capitis in IDP populations.

5.3 Recommendations

Based on the findings of this study, the following recommendations are made:

1. Regular health education programmes should be organised within the camp to raise awareness about personal hygiene, especially the dangers of sharing combs, caps, and bedding.
2. Camp authorities and supporting organisations should provide better sanitation facilities, reduce overcrowding in dormitories, and ensure access to clean water to lower infection risks.
3. Partnerships between government agencies, NGOs, and healthcare workers should be strengthened to provide periodic medical outreach services, including dermatological care.
4. Additional studies with larger sample sizes across different IDP camps should be conducted to understand regional variations, emerging resistant strains, and the psychosocial impact of tinea capitis among displaced children.

REFERENCES

Abdulrahman, M. A. (2021). *Epidemiology of tinea capitis in Northern Nigeria: Prevalence, species distribution and associated factors.* Kaduna: Ahmadu Bello University Press.

Akinboro, A. O. (2022). *Prevalence and clinical patterns of tinea capitis among school children in Osun State, Nigeria.* Ibadan: Spectrum Books Limited.

Akinrimisi, O. F. (2023). *Risk factors of dermatophytosis among displaced children in South-West Nigeria.* Lagos: University of Lagos Press.

Alemu, A. (2024). *Global perspectives on tinea capitis: Epidemiology, risk factors, and control strategies.* Addis Ababa: Ethiopian University Press.

Aliyu, M. B. (2024). *Epidemiology of tinea capitis in IDP camps of Northern Nigeria.* Kano: Bayero University Press.

Al-Janabi, A. A. H., Al-Hilali, S. A., & Al-Dabbagh, S. A. (2019). *Prevalence of tinea capitis among primary school children in Iraq: A cross-sectional study.* Baghdad: Al-Mustansiriya University Press.

Al-Janabi, K. A. (2021). *Pediatric dermatophyte infections in refugee camps: A clinical overview.* Erbil: Kurdistan Medical Publications.

Amuta, E. U. (2020). *Epidemiology of tinea capitis among children in Nigeria: Emerging trends and challenges.* Makurdi: Benue State University Press.

Ayanbimpe, G. M., Taghir, H., & Ojo, D. A. (2021). *Dermatophytosis among school children: Prevalence, species distribution and associated factors in Jos, Nigeria.* Jos: University of Jos Press.

Ayeni, T. D. (2022). *Socio-demographic correlates of tinea capitis among primary school pupils in Ibadan, Nigeria.* Ibadan: University of Ibadan Press.

Bello, M. K. (2020). *Fungal skin infections among children in conflict-affected areas of Borno State.* Maiduguri: University of Maiduguri Press.

Chukwu, O. C. (2021). *Clinical patterns and management outcomes of dermatophytosis in children.* Enugu: Fourth Dimension Publishers.

Chukwuma, E. I. (2023). *Dermatophyte infections in displaced populations: Focus on children under 15 years.* Awka: Nnamdi Azikiwe University Press.

Danjuma, A. U. (2021). *Prevalence of tinea capitis among children in IDP camps in Adamawa State.* Yola: Modibbo Adama University Press.

Edeh, F. U. (2022). *Prevalence and risk factors of tinea capitis among school children in Southern Nigeria.* Port Harcourt: University of Port Harcourt Press.

Egbujo, C. O. (2024). *Patterns of fungal infections among internally displaced children in Nigeria.* Abuja: Nigerian Institute of Public Health Publications.

Ejezie, G. C. (2022). *Health challenges in internally displaced persons camps in Nigeria.* Nsukka: University of Nigeria Press.

El-Mahdi, A. A. (2023). *Pediatric scalp dermatophytosis in humanitarian settings: A Sudanese experience.* Khartoum: Sudan University Press.

Eze, U. C. (2022). *Tinea capitis among school-aged children in refugee settlements in Abuja.* Abuja: National Open University Press.

Gupta, A. K. (2024). *Global epidemiology of tinea capitis: Shifting patterns and emerging concerns.* London: Taylor & Francis.

Ibrahim, H. M. (2021). *Clinical spectrum of tinea capitis among children in internally displaced camps.* Kano: Bayero University Press.

Idoko, J. P. (2020). *Fungal skin infections among Nigerian children: Implications for public health.* Abuja: Nigerian Health Research Publications.

Igbeneghu, C. (2023). *Socioeconomic determinants of childhood tinea capitis in Nigeria.* Ibadan: University of Ibadan Press.

Ion, D. I. (2024). *Pathogenesis, diagnosis, and management of pediatric tinea capitis.* London: Springer Nature.

Lawal, O. A. (2022). *Epidemiological survey of dermatophytosis among internally displaced children in Maiduguri.* Maiduguri: University of Maiduguri Press.

Musa, F. R. (2023). *Malnutrition and dermatophytosis in displaced Nigerian children.* Lagos: Macmillan Nigeria Publishers.

Ngouateu, O. B. (2023). *Prevalence and risk factors of dermatophytosis among school children in Cameroon.* Yaoundé: Cameroon University Press.

Nwachukwu, C. P. (2023). *Re-emergence of favus in rural Nigeria: Clinical and epidemiological perspectives.* Owerri: Imo State University Press.

Nwankwo, C. H. (2021). *Prevalence of tinea capitis among primary school pupils in Kano, Nigeria.* Kano: Bayero University Press.

Nweze, E. I. (2020). *Dermatophytosis in Northern and Southern Nigeria: Epidemiological differences and public health implications.* Enugu: Ezu Books Limited.

Nweze, E. I. (2021). *Tinea capitis and other superficial fungal infections in sub-Saharan Africa.* Enugu: Ezu Books Limited.

Nweze, E. I., & Okafor, J. I. (2018). *Prevalence and aetiology of dermatophytosis among children in Enugu, Nigeria.* Enugu: Ezu Books Limited.

Okafor, J. O. (2020). *Dermatophyte infections in Nigeria: An overview.* Nsukka: University of Nigeria Press.

Okafor, J. O. (2023). *Favus and other rare presentations of tinea capitis: Case reviews from Eastern Nigeria.* Enugu: Ezu Books Limited.

Okafor, J. O., Onuigbo, A. O., & Nwadioha, S. I. (2019). *Tinea capitis among primary school children in Ebonyi State, Nigeria: Prevalence and mycological characteristics.* Abakaliki: Ebonyi State University Press.

Okafor, P. N. (2024). *Socio-environmental predictors of dermatophytosis in IDP camp children.* Lagos: Nigerian Environmental Health Publishers.

Oke, O. O. (2021). *Risk factors and prevalence of tinea capitis among Nigerian children: A review.* Ibadan: Heinemann Educational Books.

Oke, O. O., Onayemi, O., & Olasode, O. A. (2020). *Prevalence and pattern of tinea capitis among primary school pupils in Kaduna, Nigeria.* Kaduna: Arewa Publishers.

Okonkwo, M. N. (2020). *Tinea capitis prevalence and associated risk factors in Nigerian school children.* Abuja: Nigerian Academic Press.

Olorunfemi, A. O. (2023). *Environmental determinants of infectious diseases in displaced populations.* Lagos: University of Lagos Press.

World Health Organization. (2021). *Skin diseases in humanitarian settings: Guidelines for prevention and management.* Geneva: WHO Press.

Yakubu, S. M. (2020). *Fungal scalp infections in humanitarian emergency settings: A Nigerian perspective.* Kaduna: Kaduna State University Press.

EDO STATE MINISTRY OF HEALTH
HEALTH RESEARCH ETHICS COMMITTEE

EDO STATE HEALTH RESEARCH COMMITTEE
EDO HREC

PROTOCOL NUMBER	**HA/737/25/D/05280728 (PLEASE QUOTE IN ALL ENQUIRIES)**
APPROVAL NUMBER	**HA/737/25/D/07030728**
TITLE OF RESEARCH PROPOSAL	**PREVALENCE OF TINEA CAPITIS INFECTION AMONG CHILDREN IN INTERNALLY DISPLACED PERSONS (IDP) CAMP IN BENIN CITY**
PRINCIPAL INVESTIGATOR (S)	**MOMOH JESUSEME JUDITH**
DATE CONSIDERED	**3RD JULY, 2025.**
DECISION OF THE COMMITTEE	**APPROVED**

THIS APPROVAL DATES 03/07/2025 TO 03/07/2026. IF THERE IS A DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC EDO SMoH SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK: Please kindly note that the HREC Edo SMoH seal authenticates this approval

DR (MRS.) OMONYEMEN B. BELLO
(MBBS, MPH, FPHCM) *(CHAIRMAN)* **SIGNATURE & DATE**......7/7/2025......

SUPERVISOR(S) ...Dr Mrs NA OLISE...

....

ATTESTATION BY INVESTIGATOR(S)

No participant accrual or activity related to this research may be conducted outside of the approval dates. All informed consent forms used in this study must carry the Edo SMoH HREC-assigned number and duration of your research. No changes are permitted in the research without prior approval of the Edo SMoH HREC except in circumstances outlined in the Code. The Edo SMoH HREC reserves the right to conduct compliance visits to your research site without previous notification.

Signature & Date...............
9th July 2025

APPENDIX II
INFORMED CONSENT

Department of Medical Laboratory Science,
School of Basic Medical Sciences,
University of Benin,
Benin City.

LETTER OF INFORMED CONSENT

I am a final year student of Medical Laboratory Science at the University of Benin, conducting a research study as part of the requirements for the completion of my Bachelor's degree. The study aims to determine the prevalence of *tinea capitis* infection among children in internally displaced persons (IDP) camp in Benin city.

You are being invited to participate by allowing a non-invasive head swab sample to be collected from your child/ward. This sample will be analyzed in the laboratory to detect the presence of *tinea capitis* infection.

Your Rights and Assurances:

- Participation is entirely voluntary.
- You may choose to withdraw at any time without any consequences.
- All information and results obtained will be treated with the strictest confidentiality.
- No harm will come to your child/ward during the sample collection process.
- There are no costs to you, and no financial benefit from participating.

Your consent confirms that you understand the purpose of this study and agree to allow your child/ward to participate in the sampling.

Thank you for your participation.

Sincerely,

Momoh Jesuseme Judith
07051688307
Researcher

APPENDIX III

ANTIFUNGAL AGENTS

The antifungal susceptibility discs to be used for this study will be purchased from reputable pharmaceutical suppliers in Benin. These include:

i. Griseofulvin (25 µg)

ii. Terbinafine (30 µg)

iii. Itraconazole (10 µg)

iv. Fluconazole (25 µg)

v. Ketoconazole (15 µg)

vi. Clotrimazole (10 µg)

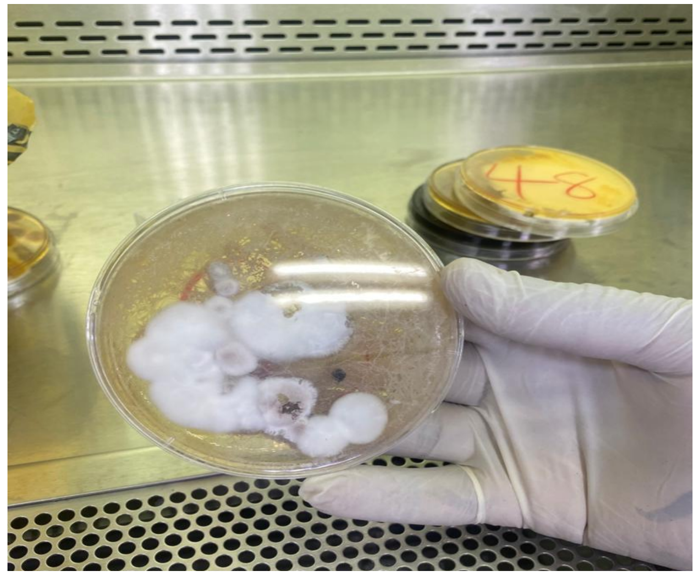
vii. Econazole (15 µg)

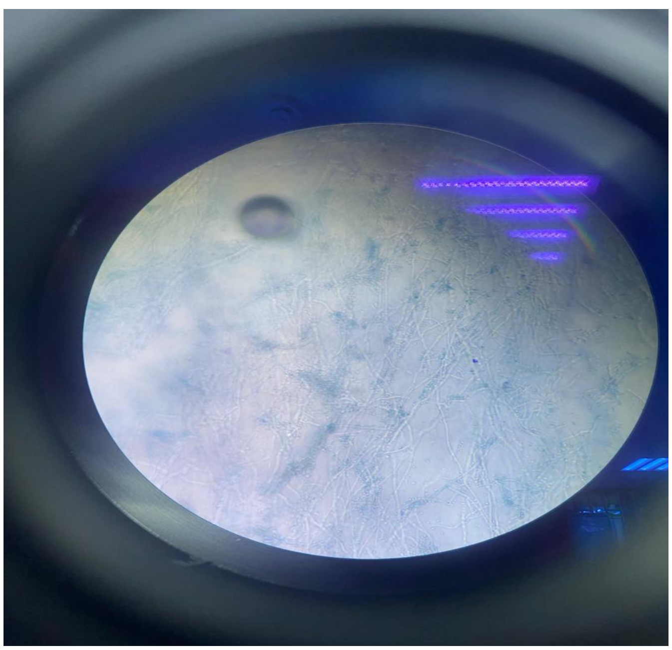
viii. Voriconazole (1 µg)

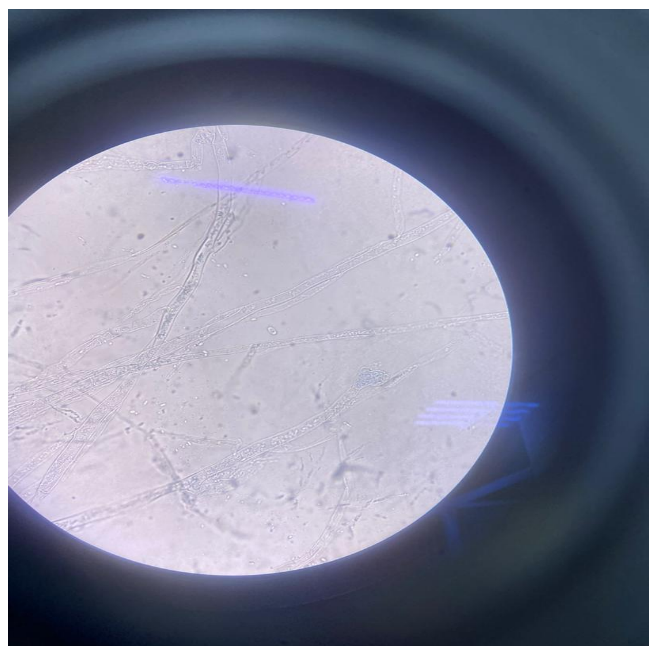
ix. Amphotericin B (20 µg)

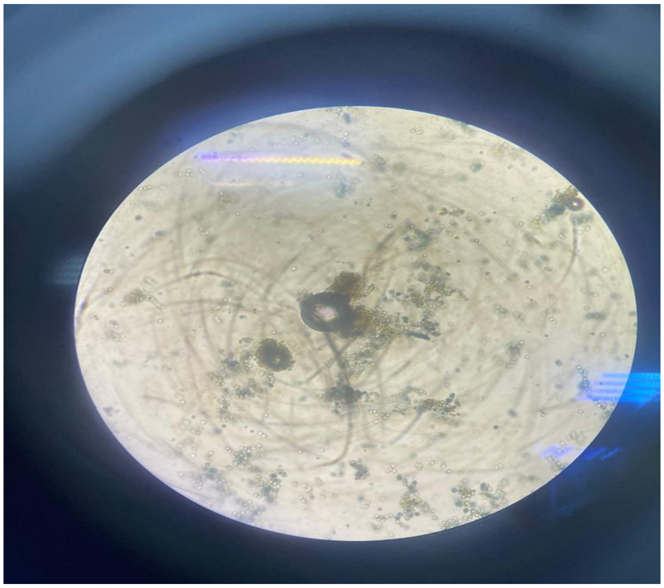
x. Nystatin (100 units)

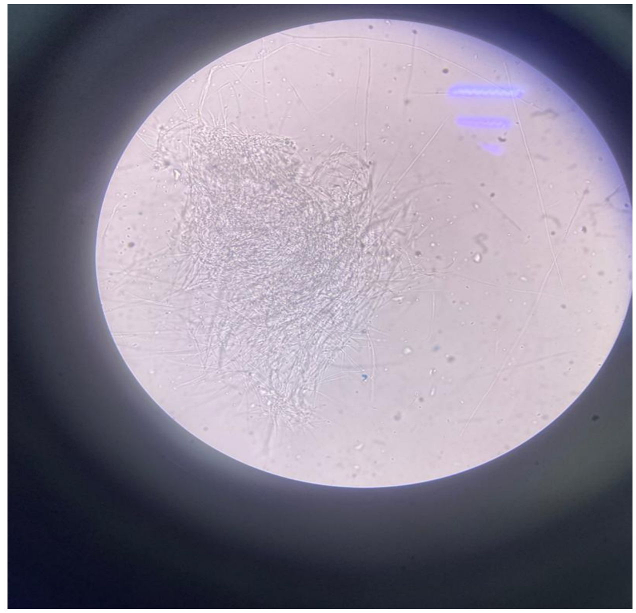
APPENDIX IV

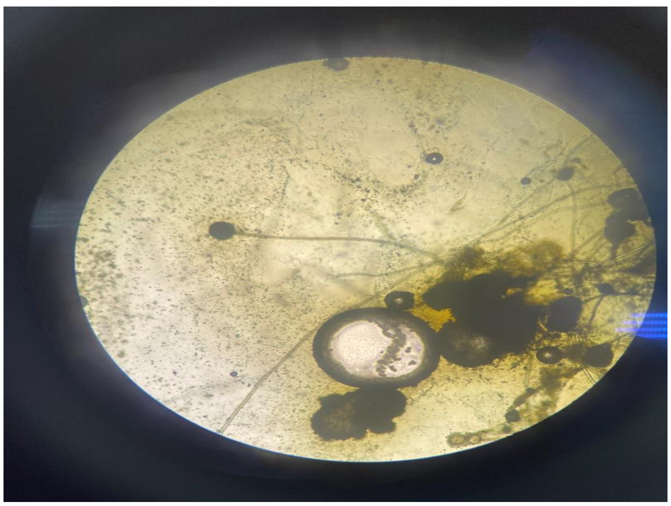













Multiplication


CLASS II
BIOLOGICAL SAFETY CABINE