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The frequency and risk factors for tinea capitis fungal infections among elementary school and kindergarten students in Al-Diwaniyah Governorate, Iraq.

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Abstract:

Background: A fungal infection of the scalp, tinea capitis is also referred to as scalp ringworm. It poses a serious risk to public health anywhere, but especially in Iraq. However, in areas with lower awareness, there are few epidemiological statistics on this illness.

Objectives: Determining the frequency and risk factors for tinea capitis in students in five locations of the Al-Diwaniyah Governorate was the purpose of this study.

Methods: A cross-sectional survey of students aged <6 to 12 years was undertaken from (October12025-to February1-2026). The children were evaluated, and samples of tinea capitis infections were taken and cultured on Sabouraud dextrose agar slopes, one containing 50 mg/ml of chloramphenicol and 500 mg/ml of cycloheximide, and one containing only chloramphenicol. After being identified by their morphological characteristics, the cultivated dermatophytes were inspected under a microscope.

Results: A total of 150 students were included. Of these, 85 (56.6%) had tinea capitis. Hairstyling in females, personal hygiene, antifungal use, and student age are all related with a lower incidence of TC (in a multivariate study of risk factors for TCs among students in Al- Diwaniyah province). In contrast, being male, being younger than the students, having a bigger family size, and not utilizing antifungal medicines were all related with an increased risk of tinea capitis development.

Conclusion: These findings highlight the need of spreading knowledge and educating people about proper cleanliness and hair styling. To better control this infection in the Al-Diwaniyah Governorate, more work is being done to improve health infrastructure and put focused public health programs into place.

Key words: Tinea capitis, Dermatophytosis, Epidemiology, Schoolchildren, Hygiene.

Introduction:

Superficial fungal infections (SFIs) are prevalent, affecting the skin, hair, and nails. They are among the most common dermatological disorders globally, and they are frequently caused by skin fungus, yeasts, and, to a lesser extent, molds (1). Fungal infections in children have increased in recent years, owing to primary factors such as skin barrier dysfunction, diabetic keratopathy, immune system defects, and secondary factors such as the use of immunosuppressive drugs, antibiotics, organ transplants, and human immunodeficiency virus ((HIV)) (2,3). An increase in fungal infections in students can be caused by a variety of host, social, climatic, and economic variables. In addition to environmental variables including long summer seasons, high humidity, and geographic location, lower socioeconomic status, poor cleanliness, overcrowding, and inadequate healthcare all contribute to an increased frequency of fungi (2,3). Many dermatophytes from the genera (M) *Microsporum* and (T) *Trichophyton* produce TCs, a fungal infection that damages the hair follicles on the scalp. Only around 12 of the approximately 40 different types of dermatophytes are known to cause illnesses in humans. There are around six main types of dermatophytes that cause TCs (4). This superficial skin fungus can cause a variety of scaly symptoms, including an inflammatory type with gray, scaly patches, scales mimicking seborrheic dermatitis, hair thinning without visible flaking, and distinct regions of hair loss with black spots (4). TCs can manifest as localized ringworm-like blisters or many broad abscesses similar to intermittent cellulitis. The disease may manifest as a minor infection or be symptom-free. TCs can be spread by sick people, infected hair, and some animal carriers. Ringworm of the scalp spreads by contaminated equipment (dirty razors, hairbrushes, and shared headgear) (5). The dermatophytes that can cause TCs vary depending on the nation and region. Furthermore, in most regions of the world, the dominant kinds might change over time. Nowadays, the most prevalent type of TCs is *Trichophyton spp*.

This study aimed to determine whether there is a gender preference and the main causes of tinea capitis in elementary school students. Additionally, the study aims to connect various host traits to clinical symptoms.

Materials and methods:

This study was carried out in Iraq/ Al-Diwaniyah Governorate from 1/10/2025-1/2/2026. The study covered all suspected clinical instances of tinea capitis that were brought to dermatological clinics during this period. Age, gender, lesion kind and duration, and the date of close contact with infected people and animals were all noted.

Samples collection procedures:

The suspected area was cleaned with 70% alcohol and left to dry before collecting the sample. Then, scratches were taken from the edge of the lesion using the blunt methods of

a sterile surgical blade (number 15) held at a 90-degree angle. Some affected hair strands with their roots were plucked using tweezers and collected in sterile paper, which allows the infected hair to be stored for long periods without a significant loss of antifungal efficacy.

Microscope examination protocols:

A drop of (10%) potassium hydroxide solution (KOH) was applied to a part of the peeled material that had been placed on a glass slide. The material (hair strands) was covered with a cover slip. The material was then evenly distributed and flattened by gradually heating and driving the slide into it. Filter paper was used to remove any extra liquid. Depending on the thickness of the scale, the slide was then held for 15 to 20 minutes. The slide was heated gradually to accelerate keratin digestion in situations with thick scales. The prepared slide was inspected under a microscope to check for arthroconidia and fungal hyphae. The sample was then injected onto two slopes of Sabouraud's dextrose agar, one containing 50 mg/ml of chloramphenicol and 500 mg/ml of cycloheximide, and the other just chloramphenicol. A sterile chromic wire spud was used for the inoculation. The inoculation tubes were incubated at room temperature after being labeled with the patient's unique identification number and date. The tubes were routinely examined for signs of growth. After four weeks, tubes that showed no signs of growth were removed.

Overall topography, growth rate, and colony characteristics were employed as growth criteria. A lactophenol cotton blue ((LPCB)) slide was created from the growth in order to examine the fine morphological characteristics of the isolated fungi. For isolates whose external appearance was difficult to distinguish on ((LPCB)) slides, a slide culture was developed to help with the identification process.

Results:

The tinea capitis infection on the pupils' scalps was clearly visible when compared to their healthy peers **(Fig 1)**.

Fig. (1) The microscopic form of tinea capitis is characterized by a few large bald patches **(A)**, whereas the hair form is characterized by numerous little bald patches **(B)**. the dissemination of TC at each research location.

Among 150 pupils sampled from AL-Diwaniyah schools, 85 (56.6%) had scalp infections. 64.7% of the children with fungal symptoms were male, whereas 35.2% were female. It was discovered that the prevalence of tinea capitis varied considerably by gender, age, grade level, and antifungal treatment. Tinea capitis was diagnosed in more male students (42.5%) than female students (25.5%). However, study indicated that the prevalence of TCs became less common as the student's age increased. The highest prevalence rate (51.9%) was reported in children under the age of five, while the lowest percentage was recorded in students aged twelve. When comparing grade levels, kindergarten pupils had a considerably greater rate of diagnosed tinea capitis (48.6%) than other grade levels. It was also discovered that family size had no significant effect on the occurrence of TCs. The majority of students with tinea capitis in the sample did not utilize antifungal treatments (61.2%), whereas (17.5%) of the affected students had a history of utilizing antifungal medications. Gender has a statistically significant correlation with the infection (p=0.034), but it was not as strong as the factor of antifungal drug use (p=0.045) and weaker than age, grade level, and family size. Due to their lowest p-value (<0.001), the study suggests that family size and grade level are the factors most closely linked to the infection. **(Table)**.

Table (1) The relationship between tinea capitis infection among school students and risk factors.

Parameter Category		Number of pupils infected	%	χ^2	df	P-Value
Gender	female	30	25.5	4.47	1	0.034
	male	55	42.5			
Age	<5	40	51.9	7.96	2	0.018
	5-10	43	22.4			
	10-12	2	10.5			
Class	Nursery	45	48.6	34.49	6	0.001>
	1	10	33.5			
	2	8	20.5			
	3	7	16.7			
	4	7	12.5			
	5	5	9.6			
	6	3	3.6			
Family size	<2	28	20.1	38.73	3	0.001>
	2-6	23	12.6			
	6-10	22	30.5			
	>10	12	45.5			
Use antifungal drugs	No	73	61.2	4.01	1	0.045
	Yes	12	17.5			

The spread of fungal species that cause tinea capitis infection in Al- Diwaniyah Governorate:

Trichophyton tonsurans, *Nannizia gypsea*, and *Trichophyton mentagrophytes* were isolated from children in Al-Diwaniyah Governorate's primary and kindergarten schools, respectively. The prevalence rates of the fungus species that cause tinea capitis varied significantly across the pupils. *T. mentagrophytes* was the most common cause of tinea capitis at 45.88%, followed by *T. tonsurans* at 35.29%, and *N. gypsea* was the least prevalent of the extant species (18.8%), as shown in **Fig 2**. *T. mentagrophytes* grew faster than other isolated fungus. *T. tonsurans*, *T. mentagrophytes*, and *N. gypsea* exhibited morphological traits ranging from fluffy white, downy white, and yellow to cinnamon.

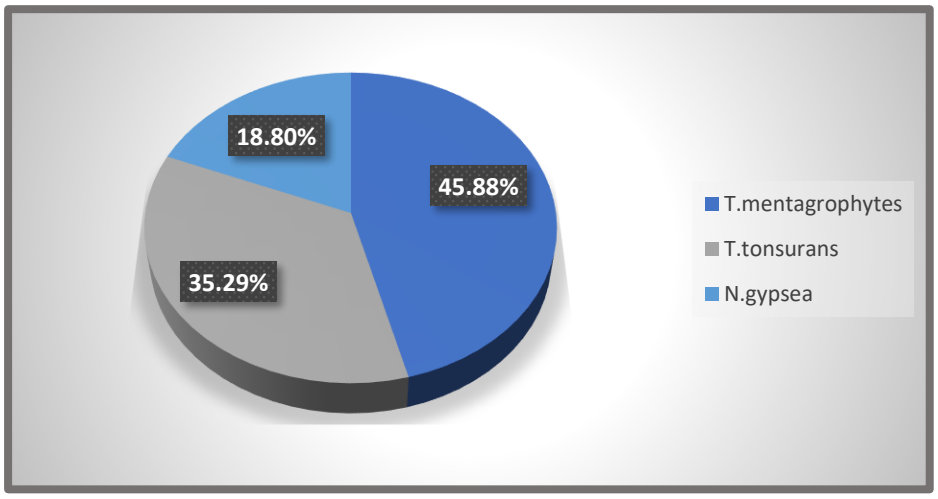

Fig. (2) Tinea capitis spread among elementary school and kindergarten kids in Al-Diwaniyah Governorate.

Skin fungus prevalence by age among children in AL- Diwaniyah Governorate:

T. Mentagrophytes was the most common in all age groups tested, however it was most common in children under the age of five, followed by those aged (<6-10) years, and finally those aged (12 years) and higher. *T. tonsurans* and *N. gypsea* were not present in students over the age of (10), whereas *T. tonsurans* was most common in pupils aged (<6-10) years **Fig3**.

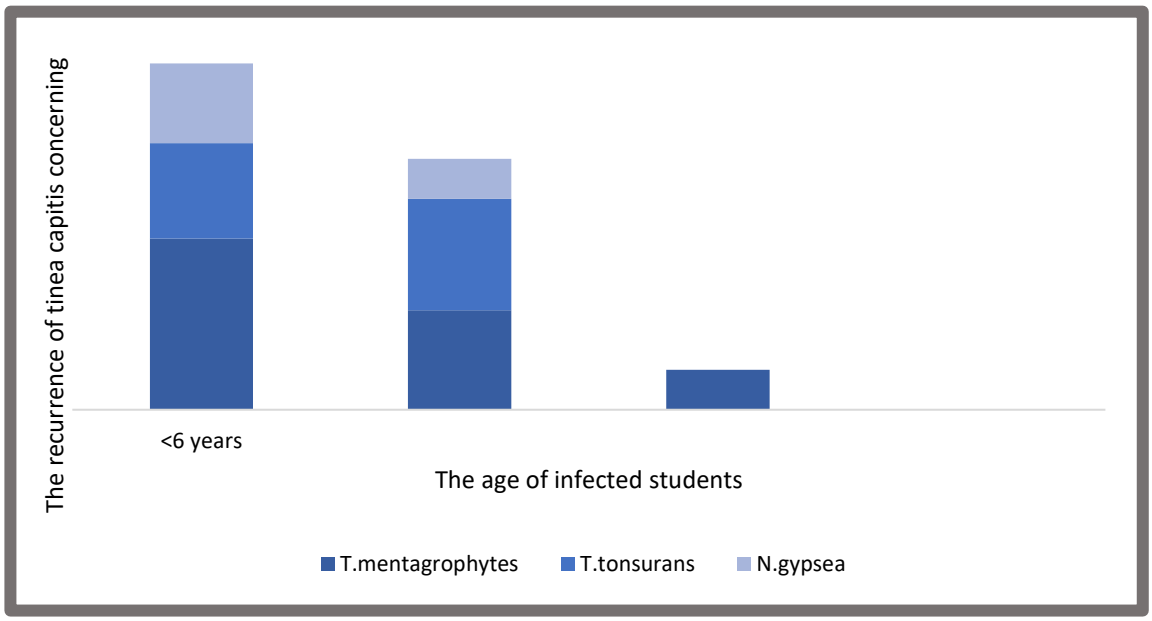

Fig. (3) Distribution of fungal disease infections affecting children in Al-Diwaniyah Governorate, by age.

When sex was considered in connection to the occurrence of the particular causal agent of TCs, it was discovered that *T. mentagrophytes* was more common in male students, although *T. tonsurans* occurred similarly in both males and girls. In contrast, female students were more likely to have *N. gypsea* **Fig4**.

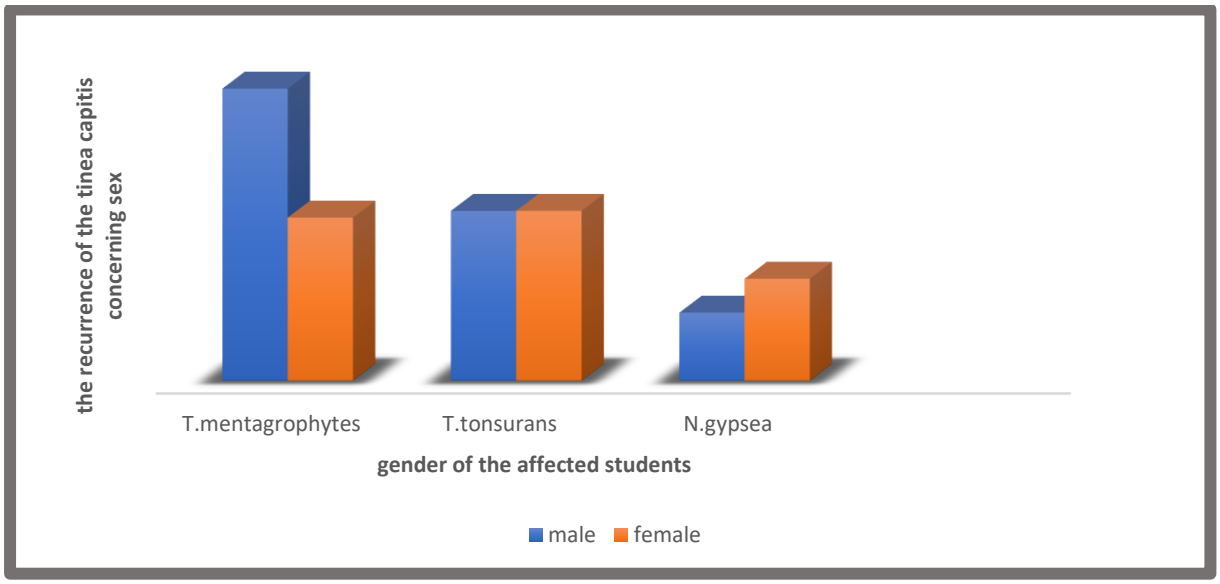

Fig. (4) Gender-specific distribution of fungal skin disease pathogens in Al-Diwaniyah Governorate children

When the *T. mentagrophytes* fungal isolate was examined under a microscope, it was found to have septate, branched hyphae that were packed with spherical microconidia **Fig. 5**.

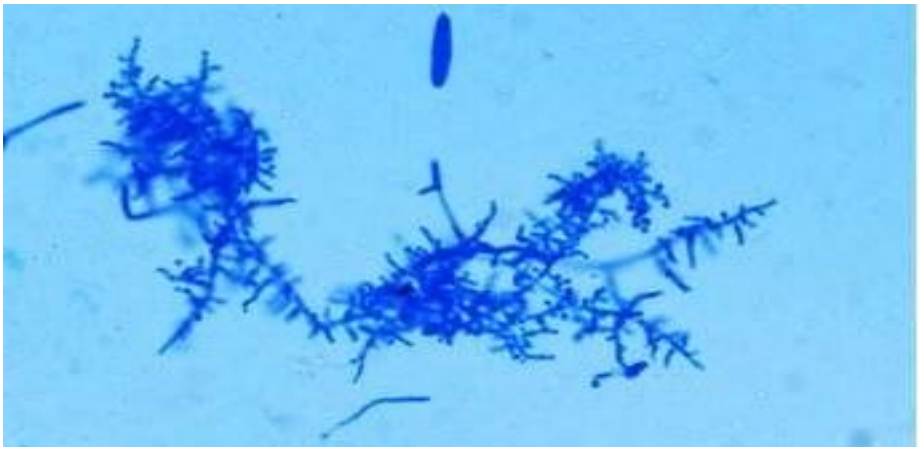

Fig. (5) shows a microscopic picture of the fungus *T. mentagrophytes* that was isolated from the scalps of Al- Diwaniya Governorate primary school pupils.

Discussion:

The purpose of this study was to assess the epidemiological profile of TC in children attending kindergarten and primary schools in five different areas of the Al-Diwaniyah Governorate. According to numerous research, tinea capitis is a serious clinical issue that is common all over the world, particularly in youngsters (6). The primary finding was that 56.6% of school-age children had TCs. This frequency is higher than the prevalence of

(21.1%) notified by Mirata et al. in their analysis of research conducted in Ethiopia (7), but it is nearly identical to what was discovered in Ethiopia by (8) Where it was (59%).

In line with other data, this study discovered a substantial link between male gender and tinea capitis, with boys accounting for 64.7% of cases. Reference (9) discovered similar patterns in Kenya, where males (45.3%) were more affected than females (36.7%). Boys are more likely than girls to have contact with pets or stray animals, which are frequently asymptomatic carriers, and their shorter hair makes them more vulnerable to fungal infection (10). However, other researches have shown that men are more likely to be infected (11,12,13,14,15).

The disease was only present in children between the ages of five and ten in this study, and it was virtually nonexistent in children between the ages of ten and twelve. This outcome is in line with several research that found that children under the age of ten account for the majority of instances (16, 17, 18). The sensitivity of skin fungus to specific sebaceous gland secretions, which initially manifest during adolescence, has been the primary cause of this (17).

The results showed that the risk of infection rose with the number of family members. The sharing of several inanimate objects, such as combs and towels, could be the cause of this. Hibstu et al. observed a similar finding in Ethiopia (10,12). The study also demonstrated a strong correlation between the child's poor personal cleanliness and the onset of TCs. Since inadequate hygiene encourages the transmission of infection, this was anticipated.

A larger frequency in remote locations may be indicated by the absence of medical tests and treatments among impacted students. This was partially supported by the findings, which showed that TCs was more common in students who did not take antifungal medications and less common in students who did (19).

The three forms of fungi that cause TCs among schoolchildren in Al- Diwaniya Governorate are *T. tonsurans*, *T. mentagrophytes*, and *N. gypsea*. *T. mentagrophytes* was the most common species, followed by *T. tonsurans*, while *N. gypsea* was the least isolated species. According to (12,20,21,22,23), *T. mentagrophytes* is the most common dermatophyte in the region due to its affinity and prevalence in humans. They discovered that TCs is predominantly caused by the dermatophyte species Trichophyton and Microsporum. The findings were also consistent with publications demonstrating that dermatophytes are easily transmitted from animals to humans (24,25). The current findings appear to contradict those reported by Adesiji et al (26) in Nigeria, who said that *T. rubrum*, like Epidermophyton species, was one of the dermatophytes responsible for infections in children throughout the research period.

Conclusion:

With an overall prevalence rate of 56.6%, this study discovered a significant incidence of TCs among children in four Diwaniya villages who were in kindergarten through primary school. The results demonstrate that the risk of infection is increased by male gender, age, the number of family members, and the absence of antifungal medications. Conversely, personal hygiene and braiding seem to reduce this risk in girls.

Recommendations:

These findings underscore the need of personal hygiene, hair grooming, and avoiding direct contact with pets, particularly in rural areas where poor living circumstances contribute to the spread of dermatophyte infections. To better reduce TCs in Al-Diwaniyah Governorate,

additional epidemiological research must be conducted in other locations, as well as public health measures.

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