

Prevalence of tinea capitis among schoolchildren in Iraq

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انتشار سعفة الرأس بين تلاميذ المدارس في العراق

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خلاصة: أجري استقصاء مدرسي على 4461 تلميذاً بالمدارس الابتدائية. حيث تم تسجيل الملامح الوبائية والسريية والفطرية لسعفة الرأس بينهم. ومن بين 204 حالة تم تشخيصها سريريا، أسفر الفحص الفطري لكشطات من الشعر وفروة الرأس عن نتائج إيجابية في 120 حالة، أي بمعدل انتشار 2.7%. وكان بين هؤلاء المئة والعشرين، 56 حالة من مدارس الحضر و64 من مدارس الريف. وبلغت نسبة الذكور إلى الإناث: بينهم 1:2. وتبين أن انتشار سعفة الرأس كان أعلى بين الأطفال ذوي الوضع الاجتماعي الاقتصادي المنخفض، متمثلاً في مستوى معيشي متدن وافتقار إلى تدابير حفظ الصحة، وانخفاض مستوى تعليم الوالدين وفرط الازدحام. ولقد وُجد أن معدل العدوى في داخل العائلات بلغ 27.5% من الحالات. كما وُجد أن 23.3% من إجمالي الحالات قد حدثت بين الوافدين حديثاً للإقامة بالمنطقة.

ABSTRACT A school survey of 4461 primary-school children was carried out. The epidemiological, clinical and mycological features of tinea capitis were recorded. Of 204 clinically diagnosed cases, mycological examination of hair and scalp scrapings gave positive results in 120, a prevalence of 2.7%. Of these 120, 56 were from urban schools and 64 from rural schools. The male to female ratio was 2:1. The prevalence of tinea capitis was higher in children with a low socioeconomic profile, i.e. low standard of living, poor hygiene, low level of parental education and overcrowded living conditions. Intrafamilial infection was found in 27.5% of cases and new settlers to the area accounted for 23.3% of total cases.

Prévalence de la teigne du cuir chevelu chez les écoliers en Iraq

RESUME Une enquête scolaire a été réalisée auprès de 4461 enfants du primaire. Les caractéristiques épidémiologiques, cliniques et mycologiques de la teigne du cuir chevelu ont été notées. Sur les 204 cas diagnostiqués cliniquement, 120 présentaient des résultats positifs à l'examen mycologique des cheveux et des produits de grattage provenant du cuir chevelu, soit une prévalence de 2,7%. Parmi ces 120 cas, 56 venaient d'établissements scolaires urbains et 64 d'établissements scolaires ruraux. Le rapport garçons/filles était de 2 pour 1. La prévalence de la teigne du cuir chevelu était plus élevée chez les enfants de condition socio-économique modeste (bas niveau de vie, hygiène médiocre, faible niveau d'instruction des parents, entassement). On a trouvé une infection intrafamiliale chez 27,5% des cas et ceux nouvellement installés dans la région représentaient 23,3% de l'ensemble des cas.

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Introduction

Most superficial mycotic infections of human skin are due to dermatophytes. Dermatophytosis can be unsightly or disfiguring, they can impede mobility and performance, cause disability or possibility pain, and, when contagious, spread from one part of the body to another or from person to person. Because of this sufferers may experience varying degrees of mental distress and anxiety. For many people the name "ringworm" still evokes the spectre of social stigma, with visions of dirt, slums and the shaven scalps that were evidence of the vast epidemics in European cities 100 years ago.

The frequency of tinea capitis compared to other types of dermatophytosis varies from one location to another. Tinea capitis is considered the most frequent cause of dermatophytosis in the Islamic Republic of Iran and Jordan [1-3] and the second most frequent form of dermatophytosis in Mosul (Iraq) after tinea corporis [4]. In contrast, there has been a marked decline in the incidence of tinea capitis in Mexico City, down from 31.0% of all cases of dermatophytosis between 1940 and 1950 to 1.6% between 1986 and 1992 [5].

This variation in the epidemiology of tinea capitis reflects people's habits, standards of hygiene, climate conditions and levels of education. Interestingly, increased education may increase the number of patients seeking medical attention for their scalp lesions, in turn increasing the diagnosed level of tinea capitis in a given area.

Tinea capitis is not a reportable disease but is a cause for concern because of its contagious nature. Children are particularly susceptible to tinea capitis and as contact among children is more frequent between the school ages of 4 years and 14 years

than in early childhood, this age group is at greater risk of contracting infectious diseases. For this reason school surveys are good at measuring the magnitude of the problem.

The objective of our study was to evaluate the extent of tinea capitis infection among primary-school children in Tikrit and the surrounding area, and to determine the relationship between socioeconomic background and other factors and the prevalence of tinea capitis.

Subjects and methods

Study population

Two groups of schools were selected to determine the prevalence of tinea capitis among primary-school children of differing socioeconomic backgrounds in Tikrit and the surrounding area. One group were from urban areas and the other from various rural areas in the vicinity of Tikrit. With the help of information from the Education Department, the following schools were selected.

Three boys' schools, three girls' schools and two large mixed schools were randomly selected from five urban areas of Tikrit (Al-Meddar, Al-Asry, Al-Gameya, Al-Askary and Al-Kadiseya). Six schools from four rural villages were chosen, one boys' school and one girls' school from Al-Door (chosen because the area had overcrowding), a boys' school and a girls' school from Mekishifa and a mixed school from both Owenate and Abo-Ageel (all three areas chosen because of their poor water supply). Data were collected between September 1994 and April 1995.

The children were preadolescent school-age children, ranging from 6 years to 15 years old. All the students at each school were included. All areas of their

Table 1 Classification of student information into risk and non-risk variables

Variable	Risk	Non-risk
Level of parental education	Illiterate Reads and writes Primary school and above	Secondary-school education
Father's position	Worker, deceased or farmer	Self-employed
Mother's position	Worker or deceased	Housewife
Level of crowding	≥ 3 people per room	1-2 people per room
Animal contact	Yes	No
Bedsharing	Yes	No
Hatsharing	Yes	No
Family history	Available	Not available

scalp were thoroughly examined for evidence of scaling, crusting, follicular inflammation, hair loss or erythema. Other parts of the body (nails, hands, chest and legs) were examined for any evidence of scaling or erythema. In each clinically diagnosed case of tinea capitis, a detailed history was recorded. Information noted was disease duration, address, socioeconomic status and the level of crowding at home. Students were questioned about their use of soap, any history of practices such as the sharing of beds, towels, combs and hats, and the existence of potentially contagious contacts, including contact with animals. Family history was also recorded and personal hygiene taken into consideration.

The socioeconomic status of the students surveyed was categorized into high level (satisfactory) and low level (unsatisfactory). This categorization took into account many factors that contribute to living standards: family size, family income, parents' educational level and parents' employment status. The level of crowding at home was calculated as the number of persons living at home per room. Each variable re-

corded was classified as a risk factor or non-risk factor (Table 1).

Information was either obtained directly from the child (if 9 years of age or older) or from their teacher (if under 9 years of age) and in certain circumstances with the aid of the school's personal file on the child.

Sample collection

In all suspected cases of tinea capitis, hair and scales were collected for mycological examination using a conventional technique. Scale scrapings were collected from at least two areas of the scalp with a number 15 sterile surgical blade and approximately 12 hair stumps (roots) were pulled out with sterile epilator forceps. Both hairs and scales were placed in a clean, labelled envelope and transferred to the laboratory for investigation.

Laboratory procedures

Three or four hairs were mounted on a clean slide in a drop of 25% potassium hydroxide solution with Parker ink, then covered with 22 × 22 mm cover slip. The slide was heated gently for a few seconds over a

low flame to digest the keratin and clear the fungal elements. The slide was examined under low and then high lens magnification for the presence of spores and/or hyphae and their distribution pattern (ectothrix, endothrix or favic type). The size and distribution of spores on the hair can provide information about the species of dermatophyte.

All samples from suspected cases were cultured, irrespective of the negative or positive examination result. Each sample was cultured on two plates of Sabouraud agar, one with penicillin/streptomycin or chloramphenicol and cycloheximide and the other with penicillin/streptomycin or chloramphenicol. The agar was inoculated by transferring some of the hair stubs and scales to the surface of the medium using a sterile straight loop and forceps. The inoculated plates were then incubated for 4-6 weeks at 28-30 °C, except in cases of suspected infection by *Trichophyton verrucosum* when it is best accomplished at 37 °C. The cultures were examined periodically for evidence of growth. Negative or contaminated plates were repeatedly reinoculated until a definite finding was established. After the growth of the dermatophytes was established, a subculture was made on Sabouraud dextrose agar for further identification.

Operational constraints

Conducting a community-based survey in a developing country is fraught with problems. These are some of the main problems we encountered and the steps we took to resolve them.

- Most people interviewed (teachers and children) were unaware of tinea capitis; its clinical features, mode of transmission and prognosis. Before examination and data collection could begin, we had

to advise the schools on the nature of tinea capitis and the objectives of our visit.

- Transportation difficulties and the distances between the schools surveyed and the laboratory.
- Some children with provisional diagnoses were absent from school on return visits for sample collection, either due to illness or cold weather, necessitating repeat visits for successful collection.
- To ease the anxieties of children about the examinations and hair removal, the survey team had to spend considerable time at each school explaining the procedure and allaying fears.
- Obtaining questionnaire information from children under 9 years of age was particularly difficult. Information often had to be obtained from older siblings, teachers or from the student's file.
- Incorrect information was sometimes given, particularly regarding monthly income and personal hygiene (frequency of bathing). As a consequence the monthly income was ignored during data analysis and personal hygiene was assessed by the survey team during interview.

Results

The total number of students surveyed was 4461; 2333 (52.3%) from urban areas and 2128 (47.7%) from rural areas. Of these, 204 children (126 males and 78 females) were provisionally diagnosed with tinea capitis (Table 2).

On mycological examination of the scalp scrapings, only 120 cases (58.8%) tested positive for the fungi with the remaining 84 cases (41.2%) testing negative.

Table 2 Distribution and percentage prevalence rate of clinically diagnosed tinea capitis according to age and sex

Age (years)	Male			Female			Total		
	Examined	Clinically diagnosed		Examined	Clinically diagnosed		Examined	Clinically diagnosed	
	No.	No.	%	No.	No.	%	No.	No.	%
6-10	1592	104	6.5	1667	59	3.5	3259	163	5.0
11-15	694	22	3.2	508	19	3.7	1202	41	3.4
Total	2286	126	5.5	2175	78	3.6	4461	204	4.6

Table 3 Age and sex distribution of tinea capitis in urban and rural areas

Age (years)	Urban area				Rural area				Total	
	Male		Female		Male		Female		No.	%
	No.	%	No.	%	No.	%	No.	%		
6-10	28	50.0	12	21.4	38	59.3	19	29.6	97	80.9
11-15	12	21.4	4	7.1	4	6.2	2	4.6	23	19.1
Total	40		16		42		22		120	

The overall prevalence rate of tinea capitis was 2.7%. The observed prevalence rate of tinea capitis among the schools varied from 0% to 8%, depending on the location of the schools, the socioeconomic conditions and level of urbanization. In the urban schools we found more tinea capitis cases in the mixed school of Al-Meddar and the schools in Al-Gameya than in the other urban schools. In the rural schools the schools of Mckishifa and the mixed school of Owenate had higher prevalence levels.

The location of all clinically diagnosed cases, either positive or negative, was recorded. Positive cases were more prevalent in rural areas, with 64 positive cases (53.3%) compared to 56 (46.7%) in urban areas. Conversely, 48 (57.1%) negative cases were found in urban areas, more than

the 36 (42.9%) in rural areas, a statistically significant difference ($P < 0.05$).

More clinically diagnosed cases were found among males, 126 (61.8%), than females, 78 (38.2%) and cases diagnosed as positive were more prevalent among males, 82 (68.3%), than females, 38 (31.7%), a male to female ratio of 2:1. Of the negative cases, 44 (52.4%) were male and 40 (47.6%) female, which was statistically significant ($P < 0.05$).

The number of children diagnosed with the infection was highest in the 6-10-year age group; 80.9% of diagnosed cases were in this group compared to 19.1% in the 11-15-year age group (Table 3). The prevalence rate was 5.8% in the 6-10 year age group and 4.8% in the 11-15 year age group ($P < 0.05$).

Table 4 Association between tinea capitis and various risk factors

Risk factor	P-value	Odds ratio
Father's education	< 0.05	2.1
Mother's education	< 0.05	13.7
Father's occupation	< 0.05	1.2
Mother's occupation	> 0.05	0.2
Animal contact	< 0.05	1.9
Overcrowding	< 0.05	4.3
Bedsharing	< 0.05	1.5
Hatsharing	< 0.05	2.4
Family history	< 0.05	6.5

Of the 120 clinically diagnosed positive cases, 81 (67.5%) came from families where the father had a low level of education and 15 (18.5%) had illiterate fathers. Nearly all of the cases, 116 (96.7%), had mothers with low levels of education, including 51 (44.0%) whose mothers were illiterate.

Slightly over half the positive cases, 67 (55.8%), were found in children living in crowded conditions of more than three persons per room; the remaining 53 (44.2%) lived in less crowded and better ventilated rooms.

A history of animal contact was found in 99 (82.5%) of the clinically diagnosed positive cases, of whom 49 (49.5%) had had contact with more than one type of animal (cattle, sheep, chicken, dogs or cats). A habit of hat sharing was customary in 30 (25.0%) cases and 86 (71.7%) children had a history of bed sharing.

A family history of infection was found in 40 (33.3%) of the clinically positive cases and 33 (27.5%) of the cases belonged to a group of 13 families. The association between tinea capitis and the various factors

as expressed by *P*-value and odds ratio is shown in Table 4.

Of the 120 positive cases, 28 (23.3%) had recently settled in the area; 7 from Egypt, 12 from Kuwait and the remainder from other parts of Iraq.

Discussion

One of the greatest problems hindering the eradication and prevention of tinea capitis is the presence of healthy, asymptomatic dermatophyte carriers. I've found that asymptomatic carriers may be equal to symptomatic sufferers [6]. We are unable to comment on the carrier rate in the present study as we only sampled children with visible signs of infection.

Our examination of 4461 primary-school children revealed a prevalence rate of tinea capitis of 2.7%. This is relatively low compared to other surveys which have shown a rate of 5% among primary-school children and the findings of Malhotra et al. in their school survey of tinea capitis in Benghazi who observed a rate of 4.49% [7,8]. Indeed, all these rates are low if compared with studies of schoolchildren in Africa; Ajao and Akintunde found a prevalence rate for clinical infection among schoolchildren in Ile-Ile of 14.02% and in urban and rural schools in Lusaka the prevalence rate was found to be 16.8% [9,10].

We believe that the low prevalence of infection in the schools we surveyed may be attributed to a routine practice of strict inspection of children by their teachers for any manifestation of scalp lesions; those children found to have lesions are prevented from attending school until treated and cured. Attapattu suggested that a custom of frequently washing heads with soap and water, especially among children, might be a reason for low prevalence of tinea capitis

in a community [11]. Low standards of living, overcrowding and poor hygiene are factors which increase susceptibility to tinea capitis infection. In addition to finding higher rates of tinea capitis in rural schools than urban schools, we found variations in the prevalence of tinea capitis between rural schools. In Owenate and Mekishifa, the infection rate was higher than in other areas because of poor standards of hygiene and problems with the domestic water supply.

Rahim reported that scalp infection was widely distributed throughout Iraq, although mainly endemic in rural districts [12]. While Yehia observed high levels of tinea capitis in rural (45.4%) rather than in urban areas (25.7%), Ghani and Yehia estimated that the frequency of tinea capitis in rural areas was lower than in urban ones [4,13]. This variation might be due to the complex mixture of both these urban and rural populations.

In our study more males than females were infected, a ratio of 2:1. A higher frequency of tinea capitis in males has been found in other studies in Iraq [4,7,12,14] and elsewhere [2,15,16]. However, this is not always the case; Woodgyer concluded that cases of tinea capitis found in children up to the age of 10 years showed no predilection for either sex [17]. He also mentioned that in the age group 11–15 years he found that the dermatophyte was more commonly isolated from females. The reason for a higher rate of scalp infection in males has been attributed to the easy implantation of spores because of short hair, the frequent sharing of combs, brushes and caps and visits to village barber whose unhygienic practices may lead to the transmission of infection from person to person.

Tinea capitis is mainly a prepubertal disease and we found a higher rate of infection in children under 11 years of age. This concurs with other studies; Yehia observed a

prevalence of infection in children aged 8–12 years of 53.8% but only 11.8% in adults [4]. Clayton reported a frequency (in London) of 71.3% of scalp infection in males and 28.7% in females, with children in the majority [18] and Karaoui et al. in Kuwait found that the frequency of infection was higher in males (48.2%) than females (22.9%) and that children under 10 years of age were the most susceptible [19].

Many studies offer explanations for the prevalence of tinea capitis in children. George reported that deficiency in sebum, which acts as a fungistatic factor, will favour infection [20]. Martinez suggested that the presence of dermatophytes on a healthy scalp may be due to commensalism and that factors such as high blood sugar levels (which are favourable to skin fungi) and the presence of fatty acids in the skin (which are unfavourable) determine the presence of these organisms and explain their gradual decline with advancing age [21].

The frequency and severity of tinea capitis infection is likely to be linked to personal cleanliness. Matinez, studying 1146 people with no clinical lesions of dermatophytoses anywhere on the body, found that only 4.6% of samples from the scalps of individuals with a clean appearance tested positive, compared with 14.8% from individuals with an unclean appearance [21]. As 12.6% of these cases were in children under 13 years of age, it seems that unclean children are the prime target of tinea capitis and serve as the chief vehicle of transmission. In our study most of the affected children, based on their personal appearance and clothing, looked unclean.

We may presume that poor personal hygiene is a reflection of a low standard of living and a low level of education within the family. A high level of parental education appears to be an important contributing

factor in lowering the prevalence of tinea capitis. Maternal education plays an important role in this regard, since children with uneducated mothers, in particular, seem to be at risk of infection in an unhealthy environment. Conversely, maternal literacy or even simple education may contribute to reducing the prevalence of the infection, irrespective of the quality of the environment in which the child lives. It is probable that the traditional behaviour of mothers (often learned during their own childhood and adolescence) along with poor personal hygiene, inappropriate child-rearing practices and attitudes toward sanitation, combined with a low degree of schooling, may all favour disease transmission.

We also found a relationship between parental occupation and tinea capitis infection, with the highest infection rates among children whose fathers were workers (50.0%) or farmers (33.3%) rather than self-employed. This may reflect the lower socioeconomic standard of the first group and poor hygiene in the second. The highest prevalence rates were also seen in children whose mothers were housewives, 114 (95.0%). This might be due to a reporting bias, since the majority of mothers in Tikrit are housewives and 27 (22.5%) of these housewives were also farmers and lived in rural areas. Housewives may be unable to contribute economically to the family and fail to gain information due to their lack of contact with the community. The link between low socioeconomic standards and increased prevalence of tinea capitis has been confirmed in other studies [4,9,12,15].

Contact with animals is considered a risk factor for tinea capitis. We found a high level of contact with animals, 82.5% of positive cases in primary-school children. In urban areas there was evidence of contact with chickens and rabbits, while in

rural areas affected children mixed with cattle, sheep, chickens and stray dogs. However, George found that animal ringworm may be acquired both through direct contact with infected animals or indirectly by transmission through fomites [20]. Sehgal et al. found that animals played a significant role in the prevalence of tinea capitis, with 18% of infected children involved in rearing animals [15].

Tinea capitis infection is also linked to overcrowding. The community around Tikrit is characterized by large families occupying a single house, where the number of family members may reach up to 25 people in one house. This results in frequent close contact between family members. A typical picture was that seen in Owenate where people live in the same style and size of house regardless of the number of family members. This link between crowded living conditions and the prevalence of tinea capitis was observed by Sehgal et al. who noticed that 85% of schoolchildren affected with tinea capitis were from families with four or more members, all living in a single-roomed house [15].

The association with overcrowding probably stems from the infectious nature of dermatophytes, and the sharing of towels, combs, pillows and hats leads to an increased risk of intrafamilial transmission. Epidemiological studies of tinea capitis have demonstrated that poor hygiene, low levels of education, proximity to livestock and overcrowding are interrelated and all contribute to the frequent transmission of the infection. Intrafamilial infection was reported in 27.5% of total cases of tinea capitis. This reflects the highly communicable nature of the disease. Intrafamilial infection was observed by Raubitscheck who deemed that the source of infection for families with a high prevalence of tinea

capitis was more likely to be the home than the school [22]. In an investigation into the prevalence of undetected tinea capitis in fellow household members of individuals documented as having the disease, the prevalence of tinea capitis in family contacts was 3.5 times higher than in the control group [23]. It was also observed that when the comparison was restricted to school-age children, tinea capitis was 9.4 times more common in the siblings of individuals with tinea capitis than in control children [23]. From this evidence we can conclude that the need for consistent follow-up of infected children is paramount, because an individual with a persistent infection can be a source of reinfection for all household members.

We also found a higher level of tinea capitis among recent settlers to the area

(immigrants) who accounted for 23.3% of cases. Immigrants to the Tikrit area had come from Kuwait and Egypt, as well as from different localities within Iraq. This explains the higher prevalence of the disease in the mixed school of Al-Meddar and the two schools for boys and girls in Al-Gameya over other schools in urban areas. The role of immigrants in the transmission of tinea capitis has also been reported by Deluol et al. who described 49 cases of tinea capitis diagnosed at the outpatient clinic of Claude-Bernard Hospital, Paris, of whom 44 had recently arrived from Africa. Maleville et al. observed a shift in the epidemiology of tinea capitis in Bordeaux and attributed this to increased immigration from West Africa [24,25].

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