

# Clinical and Epidemiological Features of Dermatophyte Infections in Almaty, Kazakhstan

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## Abstract

The cutaneous dermatomycoses are among topical issues in all countries worldwide. They are registered in 20% of the world population. Dermatophyte infections incidence frequency varies depending on a season, region, effective anti-epidemic measures management, and effective treatment methods. In Kazakhstan in 2001, dermatophyte infections ranked second in the structure of dermatologic pathology in outpatients. According to the literature data, not so many research studies on dermatophyte infections have been carried out in our country within recent years. The importance of these issues suggests a need to conduct epidemiological, clinical, microbiological studies of dermatophytosis at the present stage. A cross-sectional study was conducted, in which 195 cases of dermatophytosis were collected and investigated in the regional hospital in Almaty for the period from the beginning of January 2014 to the end of December 2014. Dermatophytoses prevalence is observed in patients within the 1 - 39 age range.

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## Introduction

Dermatophytoses incidence rate tends to increase around the world [6]. According to the WHO data, one in five people on the face of the earth has this pathology. In the structure of the cutaneous dermatomycoses, usually, dermatophytoses predominate [7]. The incidence of dermatophytosis, distribution, and etiological agent vary depending on the target geographical area, time of a study, a social and economic status of the population, climatic zone, age, presence of pets [8]. The relevance of this problem is primarily determined by the prevalence of

this type of pathological skin lesions and by growth in the number of patients both in Kazakhstan and abroad [7]. Therefore, increase in the number of infected people in the overall population, in particular, among the population living in close contact, contributes to subsequent fungal infection dissemination. In this regard, dermatophyte infections are regarded as socially significant skin diseases and have great medical and social importance for the development of new methods of diagnosis, treatment, and prevention [9].

Investigation of the prevalence of fungal dermatitis signs will provide further insight into the epidemiological situation in the region.

## Materials and Methods

A cross-sectional study has been conducted, in which 195 cases of dermatophytosis were investigated in the regional hospital in Almaty for the period from the beginning of January to the end of December 2014. Period of 2014 was characterised by the increasing incidence of cutaneous mycoses, while in 2011, 145 cases, and in 2012, even 180 cases of dermatophytosis have been recorded. In the study materials of case records over the period of 2014 were used, as well as microscopical and bacteriological examination findings for the same period. All case records of fungal infections with diagnoses according to the ICD-10 international classification were included: B 35.0 - tinea capitis et barbae, B 35.4 - tinea corporis, B 35.6 - tinea cruris, and their combinations. The study included patients 1-70 years old, men and women, diagnosed with dermatophytosis. Pregnant and breast-feeding women, patients who received systemic antimycotic drugs for 30 days before enrollment were not included in the analysis. Material for microscopical examination has been sampled from the affected areas of the patient's skin after their pre-treatment with 96% alcohol. Dermal scales were scraped with a scalpel, and crusts with epilation forceps from the periphery of the foci. The material was taken from fresh lesions. For more well-defined detection of the fungus elements, clarification of the material has been carried out using potassium hydroxide (KOH). Laboratory diagnostics of the culture-based examination was conducted regardless of the microscopy findings. The samples have been inoculated to Petri dishes with standard Sabouraud agar with 2% glucose and cultivated at the temperature of 28° for not longer than four weeks. In the absence of growth during 30 days, the results were considered negative. The grown culture served as a material for identifying the isolated dermatophyte. Statistical analysis was performed with the use of SPSS version 19. Pearson's chi-squared test was used to compare distinctions between variables.

## Results

One hundred thirty-three (68.2%) of the 195 cases of dermatophytosis were men, and 62 (31.8%) were women; the ratio of men to women was 2.14: 1. The age of the youngest patient was one year, and of the oldest one was 67 years. In this study, high dermatophytosis incidence has been seen in the age group of children from 1 to 9 years old - 41.5% of the total number of the observed patients, they are followed by groups of 10-20 years (31.3%), 21-30

years (21.5%), 31-40 years (4.1%), 41-50 years (1%) and 51-70 years (0.5%).

**Table 1: Age wise distribution with relation to clinical types**

Group	Clinical types						Total
	Tinea capitis	Tinea corporis	Combination of Tinea capitis and Tinea corporis	Tinea cruris	Combination of Tinea cruris and another skin disease	Combination of Tinea capitis, Tinea corporis and another skin disease	
0-9 years	57	10	11	0	0	1	81
10-20 years	27	18	11	4	0	0	61
21-30 years	0	19	2	18	1	0	42
31-40 years	0	5	0	2	1	0	8
41-50 years	0	0	0	2	0	0	2
61-70 years	0	1	0	0	0	0	1
Total	84	53	24	26	2	1	195

$\chi^2 = 130.2$ ;  $df = 35$ ;  $P = 0.000$

The highest incidence rate was recorded in autumn period (September to November) - 76 cases (39%), after that in summer (June to August) - 50 cases (26%), next in spring (March to May) - 37 cases (19%), and finally in winter (December to February) - 32 cases (16%).

Among 195 patients more than a half - 104 (53.3%) - were students of high schools or universities and colleges; 42 surveyed cases (21.5%) were children of preschool age, next 26 (13.3%) were classified as non-workers, 17 (8.7%) were employed by different organizations, housewives, military service men and pensioners - 3 (1.5%), 2 (1%), 1 (0.5%) respectively.

**Table 2: Table of the contingency of etiological agents with the routes of transmission of infection**

Age group	Fungal infection transmissions							Total	
	Small pet animals - cats	Small pet animals - dogs	Cattle	Contact sports (wrestling)	Visiting public baths, saunas.	Sexual contact	Contact with human carriers of fungal infection		
0-9 years	5	5	12	0	0	0	10	49	81
10-20 years	7	9	2	21	2	2	2	16	61
21-30 years	1	1	5	0	3	5	2	25	42
31-40 years	1	0	1	0	0	2	1	3	8
41-50 years	0	0	0	0	1	0	0	1	2
61-70 years	0	0	1	0	0	0	0	0	1
Total	14	15	21	21	6	9	15	94	195

$\chi^2 = 119.06$ ;  $df = 35$ ;  $P = 0.000$ .

One hundred sixty (82.1%) patients with superficial mycoses were among the rural population, and 35 (17.9%) were among the urban population.

The major occurring clinical form was superficial one - 140 (71.8%), it was characterised by the presence of one or more affected areas, of oval, round or irregular shape (in the form of geographical maps), with a clear boundary, pale pink colour, with raised spindle-shaped margin. Desquamation,

papules, vesicles, serosal crusts were observed on the surface of the lesion foci. The next most frequent form was infiltrative-suppurative - 29 (14.9%), that was a well-defined lesion focus, rising above the healthy skin, with evident acute inflammatory events in the form of swelling, pronounced hyperemia, and infiltration. Multiple pustules with copious purulent discharge and suppurative hemorrhagic crustings were observed on the surface. And infiltrative form was a little less frequent with 26 cases (13.3%). In a case of the infiltrative form, lesion focus was rising above the skin, had clear raised spindle-shaped margin, infiltrated, hyperaemic surface. Often the foci were running into one another forming bizarre shapes.

One hundred (51.3%) patients of 195 had skin lesions on the scalp (tinea capitis), skin lesion of upper and lower limbs and groin (pubis) (tinea cruris) were observed equally in 25 (12.8%) patients, combined skin lesion on torso, arms and legs were in 12 (6.2%) cases, isolated skin lesions on body (tinea corporis) were in 11 (5.6%) cases, combination of tinea capitis and tinea corporis was observed in 9 (4.6%) cases, skin lesions on groins with the transition to hips, facial skin lesions, combination of skin lesions on scalps and faces were observed in 6 (3.1%), 4 (2.1%) and 1 (0.5%) cases respectively.

**Table 3: Dermatophyte species causing different clinical presentations**

	Trichophyton Rubrum	Trichophyton Violaceum	Microsporum Ferrugineum	Microsporum Canis	Epidermophyton Floccosum	No growth	Total
Tinea capitis	41	0	1	34	0	8	84
Tinea corporis	26	0	1	22	0	4	53
Combination of Tinea capitis and Tinea corporis	12	1	0	7	1	3	24
Tinea cruris	0	0	0	0	17	9	26
Combination of Tinea cruris and other skin disease	0	0	0	0	2	0	2
Combination of Tinea capitis, Tinea corporis and other skin disease	1	0	0	0	0	0	1
Combination of Tinea corporis and other skin disease	2	0	0	1	0	1	4
Combination of Tinea corporis and Tinea cruris	1	0	0	0	0	0	1
Total	83	1	2	64	20	25	195

$\chi^2 = 156.74$ ;  $df = 35$ ;  $P = 0.000$ .

On the basis of the diagnoses, incidence of B 35.0 skin lesions (tinea capitis et barbae) were registered in 84 (43.1%) cases, B 35.4 (tinea corporis) in 53 (27.2%) cases, B 35.6 (tinea cruris) in 26 (13.3%) cases, combination of B 35.0 and B 35.4 in 24 (12.3%) cases, B 35.4 and L 23.3 or L 20.8 in 4 (2.1%) cases, B 35.6 and L 23.8 in 2 (1.0%) cases,

and combination of B 35.0 + B 35.4 + L 23.8 in 1 (0.5%) case.

Microscopy with KOH was positive in 191 (97.9%) cases, with the fungi spores detected in 106 (54.4%) cases, and mycelial filaments have been found in 85 (43.6%) cases. 4 (2.1%) cases showed a negative result. 170 (87.2%) cases of 195 cases of the bacteriological test have shown positive culture growth, in 25 (12.8%) cases growth was not observed. Among the 170 cases, Trichophyton Rubrum was the most common type of dermatophyte with 83 (42.6%) cases, further in the order of decreasing numbers follow Microsporum Canis with 64 (20.4%) cases, Epidermophyton Floccosum with 20 (10.3%) cases, Microsporum Ferrugineum with 2 (1.0%) cases, Trichophyton Violaceum with 1 (0.5%) case respectively.

## Discussion

In general, our study revealed a link between the parameters of incidence. In the beginning, let us consider the dependence of the age category on the ways of transmission of infection, the localisation of skin lesions, the diagnosis, the clinical form and the type of pathogen. Contagion through immediate contact with a vehicle of disease in 66.7% of cases occurred in the age group of 1 to 9 years old. Children at the age of 1 to 9 are infected through contacts with livestock and small pet animals in 57.1% and 35.7% of the cases respectively ( $\chi^2 = 119.9$ ;  $df=35$ ;  $P=0.000$ ). In this age group, B 35.0 was diagnosed in 67.9% of the cases ( $\chi^2 = 130.3$ ;  $df = 35$ ;  $p = 0.000$ ), isolated localization on the scalp was observed in 64% of the cases ( $\chi^2 = 155.9$ ;  $df = 45$ ;  $p = 0.000$ ). Superficial clinical form prevailed being observed in 80.2% ( $\chi^2 = 29.6$ ;  $df = 10$ ;  $p = 0.001$ ). Tinea capitis is one of the most common types of dermatophytosis observed more frequently in children, with various clinical manifestations and incidence worldwide. Children are particularly vulnerable to fungal infections, possibly because of poor personal hygiene and adverse environmental factors [10]. Perhaps the introduction of infection occurs due to hygiene breaches, and possibly as a result of low immune response. In this age group, the most common dermatophyte was Trichophyton Rubrum (51.9%), and Microsporum Canis is the second most common infectious agent in this age group (34.6%) ( $\chi^2 = 72.4$ ;  $df = 25$ ;  $p = 0.000$ ), although, according to present knowledge, Microsporum Canis, the microsporia causative agent, prevails in Europe, especially in the Mediterranean, in the United States and South America, Japan, Israel, Kuwait, Qatar, the United Arab Emirates [4, 11, 12, 13, 14, 15]. Microsporia has become the most prevalent even in regions with the traditionally high incidence of trichophytosis. So, in Dagestan,

Uzbekistan, Tajikistan, Turkmenistan, Bashkortostan, Kazakhstan, Armenia, where formerly sporadic microsporia cases were observed, currently, it is up to 83.0 to 99.7% of all hair fungal diseases [12, 13].

Now consider a clearly visible gender dependence on other indicators. In the age group of 10 to 20 years old, there are more cases (35.4%) of introduction of fungal infection through contact sports (wrestling) ( $\chi^2 = 119.9$ ;  $df = 35$ ;  $p = 0.000$ ), with localization on the scalp skin in 57.4% of cases ( $\chi^2 = 155.9$ ;  $df = 45$ ;  $p = 0.000$ ). In this age group, *Microsporum Canis* prevails in 47.5% of cases ( $\chi^2 = 72.4$ ;  $df = 25$ ;  $p = 0.000$ ). It is known that in the Russian Federation *M. canis* is the most often recorded microsporia causative agent [31]. It falls into the category of the widespread zoidiophilous fungi, which cause dermatophytosis in cats (especially in kittens), dogs, monkeys and other animals [16, 17].

In the age categories of 21 to 30 years old and 31 to 40 years old, the prevalence of sexual transmission of fungal infection is observed: 11.9% and 25.0% of the total number of cases in these categories respectively ( $\chi^2 = 119.9$ ;  $df = 35$ ;  $p = 0.000$ ), with only public localization in the category of 21-30 years old (40.5%); in the category of 31 to 40 years old, lesions mostly often localize on the skin of upper and lower limbs (50.0%) ( $\chi^2 = 155.9$ ;  $df = 45$ ;  $p = 0.000$ ). Clinical form is superficial in 50.0% and 62.5% of cases respectively for these categories ( $\chi^2 = 29.6$ ;  $df = 10$ ;  $p = 0.001$ ). In this age group, among the dermatophytes the most common causative agent was *Trichophyton Rubrum*, 35.7% and 37.5%, respectively ( $\chi^2 = 72.4$ ;  $df = 25$ ;  $p = 0.000$ ). According to some expert estimates, the share of tinea cruris accounts for 10% of the overall structure of the fungal infection with a majority of dermatophyte *Trichophyton verrucosum* 97.7% [18, 19, 20], the share of other tinea cruris causative agents is 12.3% with a majority of *Epidermophyton Floccosum* in 20-25% of cases [21, 22].

In the age groups of 41 to 50 years old and 61 to 70 years old, the incidence of fungal infections in the study is minimal: 2 and 1 cases respectively. In the age group of 41 to 50 years old, the infection disease was transmitted through use of a common bath, and in the age category of 51 to 70 years old, the infection disease was transmitted through cattle. Affected areas in patients of 41 to 50 years of age were only the pubic region with *Epidermophyton Floccosum* identified in 100% of cases; and in patients of 61 to 70 years of age, tinea corporis prevailed with identified *Microsporum Canis*. Clinical form in the category of 41 to 50 years of age is infiltrative, and patients at the age of 61 to 70 years had the surface form.

Among men, the infection was predominantly

transmitted by means of contact sports (wrestling) in 15.0% of cases; among women that was contact with the infection carriers in 11.3% of cases ( $\chi^2 = 15.99$ ;  $df = 7$ ;  $p = 0.025$ ). B 35.0 in conjunction with B 35.4 were diagnosed in 100% of men only. B 35.4 in conjunction with B 35.6 were diagnosed only in women ( $\chi^2 = 15.52$ ;  $df = 7$ ;  $p = 0.03$ ). Clinical form in men and women is predominantly superficial 75.2% and 64.5% respectively ( $\chi^2 = 6.73$ ;  $df = 72$ ;  $p = 0.034$ ). The bacteriological examination, in both men and women, *Trichophyton Rubrum* prevailed in 50% and 42.6% of cases respectively ( $\chi^2 = 11.78$ ;  $df = 5$ ,  $p = 0.038$ ). These data differ from those of A.Karibayeva. Conducted in Almaty 2003-2007, then the main causative agent of the infection was *Trichophyton violaceum* [34].

The dependence of the time of year on the ways of transmission of infection, the clinical form of skin lesion and the prevalence of one or another type of causative agent of infection is also traced in this work. In winter season (December to February), contacts with human carriers were the most common channel of infection in 19.4% of cases; in spring season (March to May), both contacts with human carriers and contacts with small pet animals (cats) were 12% of cases each. In the summer season (June and July), contacts with small pet animals (dogs) were the most common channel of infection in 17.1% of cases, in 15.8% of cases that were contacted with cattle, and in 15.8% of cases that were contact sports (wrestling). And in autumn season (September to November), in 10.8% of cases contacts with cattle and contact sports (wrestling) were the most common channel of infection; these data are statistically significant ( $\chi^2 = 6.73$ ;  $df = 72$ ;  $p = 0.034$ ). In contrast, in the dermatophytosis study conducted in Mali, performed multivariate analysis has shown no statistical significance regarding climatic factors and factors of transmission [23].

About clinical forms, in winter (December to February), spring (March to May) and summer (June and July) seasons, the infiltrative-suppurative form was the most common: 27.6%, 24.1% and 31.0% of cases respectively. And superficial clinical form prevailed in autumn season (September to November) with 49.3% of cases ( $\chi^2 = 26.711$ ;  $df = 8$ ;  $p = 0.001$ ).

In winter season, cultures of *Microsporum Canis* was the most frequently identified with 38.7% of cases; in spring season, cultures of *Epidermophyton Floccosum* were identified in 27.0% of cases; in summer season, *Trichophyton Rubrum* in 68.0%, and in autumn season, *Microsporum Canis* in 46.1% of cases ( $\chi^2 = 60.97$ ;  $df = 20$ ,  $p = 0.000$ ).

The relationship between the transmission routes of infection and the prevalence of one or another type of pathogen. Where the infection is transmitted through contacts with small pet animals,

cats and dogs, *Trichophyton Rubrum* prevailed in 50.0% and 46.7% of cases respectively. The same results with the highest proportion of *Trichophyton Rubrum* and predominance of domestic cats as infection sources have been shown in the study in the Republic of Bashkortostan, Russia [24]. Where the infection is transmitted through contacts with cattle, *Trichophyton Rubrum* was identified in 57.1% of cases; and where the infection is transmitted through contact sports (wrestling), *Microsporum Canis* was the most common causative agent in 57.1% of cases. In the case of infection when visiting public baths, saunas, and in the case of sexual contacts, the growth of *Epidermophyton Floccosum* was observed in 33.3% *Floccosum* and 77.8% of cases respectively. And where the infection was transmitted through contacts with people carriers, *Microsporum Canis* showed prevailing growth rate in 53.3% of cases ( $\chi^2 = 86,375$ ;  $df=35$ ;  $P=0$ ).

The study has demonstrated that cultural growth with positive microscopy results with KOH was observed in 191 of 195 cases, cultural growth with negative microscopy results with KOH was observed in 3 of 4 cases ( $\chi^2 = 0.29$ ;  $df = 1$ ), i.e. there is no relationship.

In conclusion, the conducted study has demonstrated a high incidence of fungal infection in patients with the age range between 1 to 39. *Trichophyton Rubrum* is the most common causative agent of tinea capitis and tinea corporis; this differs from the data of the publications of colleagues from Germany and Britain, where it is indicated that *Trichophyton Rubrum* is rarely detected in the scalp and children it is up to 1% [32, 33]. And there is a high prevalence *Epidermophyton Floccosum* is the most common causative agent of tinea cruris. It is noted that small pet animals, cats, dogs are the most common transmitters of dermatophytes *Trichophyton Rubrum*; *Epidermophyton Floccosum* is transmitted

when visiting public baths, saunas and by sexual contact. Statistically, the significant relationship has been shown between the studied parameters of the fungal diseases. Some study data are similar to the overall mycoses statistics data; some others do not match similar studies data acquired in other countries, this evidences the presence of special features of mycoses in this region of Kazakhstan. In-depth study of the identified relationships requires a broader sample of observations for further studies using deeper statistical methods.

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