

# Epidemiology of dermatophytoses in paediatric population in Southwestern Poland, 2011–2016

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## Abstract

**Introduction:** Dermatophytoses are the most common superficial fungal infections in paediatric population. Its pathogen pattern has changed over years.

**Aim:** To analyse the spectrum of dermatophytoses in children living in Southwestern Poland, in the years 2011–2016.

**Material and methods:** A total of 1705 patients were diagnosed with fungal skin infection in the Mycological Laboratory, Dermatology Department of the Wrocław Medical University. Of them, 163 were under 18 years of age.

**Results:** In 105 cases, dermatophytoses were detected. The collected specimens were examined using direct microscopy examination, staining, culture on specific media and PCR technique. The most common dermatophytes were *Trichophyton rubrum* and *Trichophyton tonsurans* (31.4% each), followed in the descending order by *Trichophyton mentagrophytes* (21.9%), *Microsporum canis* (13.3%) and *Epidermophyton floccosum* (1.9%). The most commonly affected body sites were glabrous skin of the trunk and extremities (41.7%), followed by face (22.2%), scalp (15.7%) and toe nails (14.8%).

**Conclusions:** This study revealed the most common types of dermatophytoses and their pathogens in children in Southwestern Poland. In comparison to earlier data obtained from this region, new epidemiological trends have been revealed. We observed the shift towards anthropophilic dermatophyte infections and an increasing number of onychomycosis in children. Because of climatic variations, migration, and changing lifestyle practices, further studies on dermatophytoses are necessary to improve our knowledge on the epidemiology of fungal infections.

**Key words:** epidemiology, dermatophytes, *Trichophyton rubrum*, children, Poland,

## Introduction

Fungal infections of the skin in paediatric population constitute a major clinical, etiological and therapeutic problem. They are less common in children than in adults, however predominate in the group of infectious skin disorders in paediatric population [1]. Many studies have led to significant differences in the affected parts of the skin or predominant etiological factors, compared to adult population. There are also dissimilarities in the prevalent type of fungi, depending on the age group, location or geographic region and it is still fluctuating.

## Aim

The purpose of the study was to analyse-epidemiology of fungal infection in children living in Southwestern

Poland. To observe epidemiological trends in this population over the years we compared our results with previous data from this region and other parts of the world.

## Material and methods

During the 5-year period, 2011–2016, 11004 patients were examined in the Mycological Laboratory, Dermatology Department of the Wrocław Medical University. Out of 1705 patients with a confirmed fungal skin infection, 163 (9.6%) were under 18 years of age.

The pathological material (skin scales, plucked hair and nail clippings) were collected with a scalpel blade. The specimens were prepared with the use of 20% potassium hydroxide solution and dimethyl sulfoxide and examined with direct microscopy. Cultures were inoculated into Sabouraud dextrose agar containing cyclohexi-

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midé and incubated for 4 weeks at room temperature. Identification of isolated dermatophytes was based on the macroscopic and microscopic features of the colonies. In selected cases to confirm the diagnosis, PCR was performed. Statistical analysis was performed using the  $\chi^2$  test. *P*-values of less than 0.05 were considered significant.

The patients were divided into four groups: less than 2 years, 2–6 years, 6–12 years and 12–18 years.

## Results

The results are presented in Tables 1–5. In the group of 163 examined children with a confirmed fungal skin infection, in the collected samples dermatophytes were detected in 105 children, followed by infections caused by yeasts (32%). There were also 8 cases of moulds culture obtained from the examined sample (5%).

The group of dermatophyte infections included 40 (38.1%) boys and 65 (61.9%) girls. In 3 cases we observed infection in two locations. Among them the most frequently isolated species were equally *Trichophyton rubrum* and *Trichophyton tonsurans* (33 cases, 31.4% each), followed by *Trichophyton mentagrophytes* (23 cases, 21.9%). Other pathogens included *Microsporum canis* (14 cases, 13.3%) and *Epidermophyton floccosum* (2 cases, 1.9%) were less frequent (Table 1).

The most commonly affected areas were glabrous skin of the trunk and extremities (45 cases, 41.7%) and face (24 cases, 22.2%), followed by scalp (17 cases, 15.7%) and toe nails (16 cases, 14.8%). Infections of feet, finger nails and groins were observed sporadically (Table 2).

On the glabrous skin of the trunk and extremities the most common detected agent was *T. tonsurans* (16 cases, 35.5%). *T. rubrum* and *T. mentagrophytes* were obtained in 11 cases each (24.4% each). Less frequently isolated dermatophytes were *M. canis* (6 cases, 13.3%) and 1 case of *E. floccosum*. In the face *T. mentagrophytes* prevailed (11 cases, 45.8%), followed by *T. rubrum* (9 cases, 37.5%). In the scalp *M. canis* was the predominant factor, observed in 7 (41.2%) cases followed by *T. tonsurans* (5 cases, 29.4%) and *T. rubrum* (3 cases, 17.6%). In the toenails the predominant etiologic agent was *T. rubrum* (14 cases). There were also 2 cases of *T. tonsurans* isolat-

ed. In the fingernails 2 cases of *T. rubrum* were detected. On the feet only single cases of *T. rubrum*, *T. tonsurans*, and *T. mentagrophytes* were isolated (Table 3).

In the analysed age groups, the group that was most affected by fungal infections was the 6–12-year-old group (47 cases, 43.5%), followed by younger children (2–6-year-old group), where positive samples were found in 34 (31.5%) cases. Fungal infections were less common (19.4%) in teenagers (12–18-year-old group) and sporadic (5.6%) in the youngest children (0–2-year-old group).

In the 0–2-year-old group scalp was affected in 2 children and that was the most prevalent location of skin lesions. *T. rubrum* was the most frequently isolated fungus from all locations, in this age group. In the 2–6-year-old group the most common affected location was glabrous skin of the trunk and extremities (14 cases) and in this location *T. tonsurans* prevailed (8 cases), followed by *T. mentagrophytes* (3 cases), *T. rubrum* (2 cases) and *M. canis* (1 case). Other locations were the face and scalp (7 cases each). We did not observe fungal infections of feet, hands, groins and finger nails in this age group.

In the 6–12-year-old group the most commonly affected location was glabrous skin of the trunk and extremities (18 cases), followed by face (15 cases) and scalp (8 cases). We did not observe fungal infections of hands and fingernails in this age group. The most predominant factors in 6–12-year-old children were *T. mentagrophytes* and *T. tonsurans* (13 cases each), followed by *T. rubrum* (12 cases).

In the 12–18-year-old group the glabrous skin of the trunk and extremities (12 cases) was the most prevalent location of skin lesions, followed by toe nails (5 cases) and feet (2 cases). We did not obtain scalp, hands and groins infections in this age group. The most commonly detected causative agent was *T. tonsurans* (8 cases) followed by *T. rubrum* (7 cases).

In all age groups, girls were significantly more often affected than boys. The biggest disproportion was shown in 0–2-year-old and 6–12-year-old groups, where in female population positive cultures were noticed, in

**Table 1.** Isolation frequency of dermatophytes

Dermatophytes	N (%)
<i>Trichophyton rubrum</i>	33 (31.43)
<i>Trichophyton tonsurans</i>	33 (31.43)
<i>Trichophyton mentagrophytes</i>	23 (21.91)
<i>Microsporum canis</i>	14 (13.33)
<i>Epidermophyton floccosum</i>	2 (1.90)
Total	105 (100)

**Table 2.** Most commonly affected locations in paediatric population

Location	N (%)
Glabrous skin of the trunk and extremities	45 (41.67)
Face	24 (22.22)
Scalp	17 (15.74)
Toe nails	16 (14.81)
Feet	3 (2.78)
Finger nails	2 (1.85)
Groins	1 (0.93)
Total	108 (100)

**Table 3.** Location of dermatophytoses according to the species

Species	Scalp	Face	Glabrous skin of the trunk and extremities	Feet	Finger nails	Toe nails	Groins	Total
<i>Trichophyton rubrum</i>	3	3	11	1	2	14	1	35
<i>Trichophyton tonsurans</i>	5	9	16	1		2		33
<i>Trichophyton mentagrophytes</i>	1	11	11	1				24
<i>Microsporum canis</i>	7	1	6					14
<i>Epidermophyton floccosum</i>	1	0	1					2
Total	17	24	45	3	2	16	1	108

**Table 4.** Location of fungal infections in the different age groups

Parameter	Age								Total
	0–2		2–6		6–12		12–18		
Sex	B	G	B	G	B	G	B	G	
Glabrous skin of the trunk and extremities	1	0	6	8	2	16	5	7	45
Face	1	0	3	4	6	9	0	1	24
Scalp	0	2	3	4	5	3	0	0	17
Toe nails	0	1	3	3	1	3	2	3	16
Feet	0	0	0	0	0	1	1	1	3
Finger nails	0	1	0	0	0	0	0	1	2
Groins	0	0	0	0	1	0	0	0	1
Hands	0	0	0	0	0	0	0	0	0
Total	2	4	15	19	15	32	8	13	108

B – boys, G – girls.

66.7% and 68.1% of cases, respectively. Glabrous skin of the trunk and extremities was most frequently affected in both genders (Tables 4, 5).

## Discussion

Superficial fungal infections in paediatric population vary in terms of causative agents and their prevalence due to the geographical region and over time in the same area. In our study the most prevalent causative agents were dermatophytes (63%). Among them the most frequently isolated was *T. rubrum* which is also most frequently isolated dermatophyte in the whole population of western Europe [2–4] and worldwide [5]. Another anthropophilic species, occurring in our study equally as often as *T. rubrum*, was *T. tonsurans* which is also on rise in Europe, especially in the UK [6, 7], Germany [8], and in the USA [9]. A high incidence of *T. tonsurans* may be linked with routine outbreaks of *tinea corporis et capitis gladiatorum* due to *T. tonsurans* among wrestlers, usually children and adolescents [10]. We observed a shift towards anthropophilic dermatophyte infections when comparing our data with the results of research from previous years conducted in Southwestern Poland, in

**Table 5.** Most commonly detected species in the different age groups

Age	<i>T. rubrum</i>	<i>T. tonsurans</i>	<i>T. mentagrophytes</i>	<i>M. canis</i>	<i>E. floccosum</i>
0–2	3	0	1	1	1
2–6	11	12	5	5	0
6–12	12	13	13	7	0
12–18	7	8	4	1	1
Total	33	33	23	14	2

which zoophilic dermatophyte *T. mentagrophytes* was the predominant factor (37%), followed by *T. rubrum* (28%) [2]. The increase in dermatophytosis caused by anthropophilic species is nowadays a worldwide trend in epidemiology of fungal infections [3], however, in northern Poland [11], Greece [12] and France [13], zoophilic dermatophyte *M. canis* remains the predominant etiological factor in paediatric population. Interestingly, in our study anthropophilic *T. mentagrophytes var. interdigitale* was not detected. This phenomenon is worth emphasizing because in earlier studies covering whole Poland this variety was observed in 6.6% of detected dermatophytoses in the general population [14].

The most commonly affected body areas were glabrous skin of the trunk, extremities (41.7%) and face (22.2%), followed by scalp (15.7%). This finding is in agreement with our previous data collected in 2004–2008 [2] and data from Greece [15]. However in many parts of the world like Iran, Jordan or Brazil, tinea capitis is the most common superficial mycosis in children [16–19]. In our survey the most frequent causative agent of tinea capitis was zoophilic *M. canis*, which has been the dominant agent of tinea capitis in our region for decades [20, 21]. The predominance of this dermatophyte in tinea capitis is emphasized also in central and northern Poland [8, 22], Austria, Spain, Italy, Greece, Hungary and Germany [16, 23–27]. However *T. tonsurans*, detected in our study as a second dermatophyte causing tinea capitis,

has lately emerged as the dominant agent in many regions, replacing *Microsporum* spp. [28]. *T. tonsurans* was most frequently detected dermatophyte in glabrous skin of the face (37.5%), trunk and extremities (35.5%) in our study, while in 2004–2008 it was detected significantly less often, in nearly 10% of cases [2].

The location of paediatric dermatophytoses varies with the age of the child. In our study, we observed a relationship between the age of patients and the most common location of skin lesions. The most common body area affected in 2–18-year-old groups was glabrous skin, followed by the face and scalp in 2–12-year-old group and toe nails in 12–18-year-old group, while in 12–18-year-old group we did not observe any scalp infection and only 1 child had infection located on the face. The most frequently isolated dermatophyte in children over 6 years old, *T. tonsurans*, has not been detected in the youngest group (0–2-year-old group). Similar results were obtained in other studies [2, 7].

We also demonstrated that there are significant differences between children and adults. We compared our data with results from a survey conducted in our region in the general population in 2011–2016 [29]. *T. rubrum* was also the most prevalent causative agent detected in 71.75% of cases, followed by *T. tonsurans* observed in 16.77% of cases. In the general population the most commonly infected body sites were toenails (51.45%) and fingernails (17.17%). Glabrous skin came third in terms of frequency (15.93%). These results are comparable with previous data obtained in the general population in 2003–2007 [30].

Fungal infections typically presented in adults have recently appeared in children more frequently than before. In our study we observed 18 cases of finger and toe nails dermatophyte infections (16.7%). According to data collected in 2004–2008 in our area, toenails were affected in 3.9% and finger nails in 2.3% in children population [2].

## Conclusions

The results of this retrospective survey have revealed changes in the epidemiological features of dermatophytoses in paediatric population in Southwestern Poland over 12 years. We observed a shift towards anthropophilic dermatophyte infections and an increasing number of onychomycosis in children. Further studies on dermatophytoses are necessary to improve our knowledge on the new epidemiological trends in this area which may be caused among others by climatic variations, migration, and changing lifestyle practices.

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Anna Gawdzik and Katarzyna Nowogrodzka equally contributed to this work.

## Conflict of interest

The authors declare no conflict of interest.

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