



Clinico-mycological assessment of pediatric dermatophytosis: experience of an eastern Indian tertiary hospital

Pediatric dermatofitozun klinik-mikolojik değerlendirmesi: Doğu Hindistan üçüncü basamak hastanesinin deneyimi

✉ Arya Bose*, ✉ Abheek Sil**, ✉ Loknath Ghoshal***

*Institute of Child Health, Department of Dermatology, Institute of Child Health, Kolkata, India

**PKG Medical College and Hospital, Department of Dermatology, West Bengal, India

***Malda Medical College, Department of Dermatology, West Bengal, India

Abstract

Background and Design: The ongoing rampage of dermatophytic infection continues to challenge dermatologists with its varied presentations, sparing no age group. Thus, this study was undertaken to assess the clinical, demographic, and microbiological aspects of childhood tinea infection.

Materials and Methods: A descriptive, cross-sectional study was conducted in 200 consecutive pediatric patients (under 14 years of age) diagnosed with dermatophytosis between January 2019 and March 2020. All patients underwent detailed history, thorough clinical examination, microbiological confirmation with potassium hydroxide mount and fungal culture.

Results: The majority of the study population (44.5%) belonged to the 3 ≤9 years age group with a mean age of 6.1 ± 3.3 years, with an overall male predominance. More than one-third of the patients (39%) belonged to the 'low' socioeconomic stratum and lived in rural areas. Similar affliction among family members was recorded in 83.5%. Chronic and recurrent dermatophytosis was diagnosed in 9% of patients. The most common site involved was the trunk. Clinically, the most commonly diagnosed condition was tinea corporis (92%). More than half of the patients (53.5%) reported usage of prior topical steroid-laced creams. The most common fungus was *Trichophyton mentagrophytes*.

Conclusion: A substantial pediatric population is afflicted by the ongoing scourge of superficial dermatophytosis. Results from our study corroborate with the studies done by Indian investigators on adult patients suffering from dermatophytosis. Multicentric collaboration with added molecular studies assessment is needed to address this growing concern in the pediatric age group.

Keywords: tinea, childhood, fungal, epidemiology, microbiology, epidemic

Öz

Amaç: Dermatofitik enfeksiyonun süregelen yaygınlığı, çeşitli klinik görünüşleri ile, her yaş grubunu etkileyerek dermatologları zorlamaya devam etmektedir. Bu nedenle, bu çalışma çocukluk çağı tinea enfeksiyonunun klinik, demografik ve mikrobiyolojik yönlerini değerlendirmek amacıyla yapılmıştır.

Gereç ve Yöntem: Ocak 2019 ile Mart 2020 tarihleri arasında dermatofitoz tanısı almış 200 ardışık pediatrik hastada (14 yaş altı) tanımlayıcı, kesitsel bir çalışma yürütüldü. Tüm hastalara ayrıntılı öykü, kapsamlı klinik muayene, potasyum hidroksit ile direkt inceleme ve mantar kültürü ile mikrobiyolojik doğrulama yapıldı.

Bulgular: Çalışma popülasyonunun çoğunluğu (%44,5) 3 - < 9 yaş grubuna aitti ve ortalama yaş 6,1 ± 3,3 yılı ve genel olarak erkek egemenliği vardı. Hastaların üçte birinden fazlası (%39) 'düşük' sosyoekonomik tabakaya aitti ve kırsal alanlarda yaşıyordu. Hastaların %83,5'inde aile bireyleri arasında da benzer bir hastalık kaydedildi. Hastaların %9'unda kronik ve tekrarlayan dermatofitoz tanısı kondu. En sık tutulan bölge gövde olarak tespit edildi. Klinik olarak en sık teşhis edilen durum tinea korporis idi (%92). Hastaların yarısından fazlası (%53,5) daha önce topikal steroid içeren kremler kullandığını bildirdi. En sık rastlanan mantar türü *Trichophyton mentagrophytes*'ti.

Address for Correspondence/Yazışma Adresi: Abheek Sil MD, DNB, SCE, MNAMS, PKG Medical College and Hospital, Department of Dermatology, West Bengal, India

E-mail: abheek.sil@gmail.com **ORCID:** orcid.org/0000-0002-8043-2721

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Sonuç: Geniş bir pediatrik popülasyon, süregelen yüzeysel dermatofitoz sorunundan etkilenmektedir. Çalışmamızdan elde edilen sonuçlar, Hintli araştırmacılar tarafından dermatofitozdan etkilenen yetişkin hastalar üzerinde yapılan çalışmalarla desteklenebilir. Pediatrik yaş grubunda giderek artan bu endişeyi gidermek için moleküler çalışmaların da eklendiği çok merkezli işbirliğine ihtiyaç vardır.

Anahtar Kelimeler: pediatri, tinea, mantar, epidemiyoloji, mikrobiyoloji, salgın

Introduction

Dermatophytosis is a fungal infection that invades the keratinized tissues of the host (skin, hair, and/or nails).¹ Once considered an easy-to-manage condition, dermatophytoses have over the past decade emerged as a nagging public health problem.² Unscientific usage of topical steroid and fixed-drug combination creams, emergence of *Trichophyton mentagrophytes* as a causative pathogen, and the growing emergence of antifungal resistance (particularly to terbinafine) have added fuel to this fire.^{3,4} Furthermore, the chronicity, financial burden, visibility of the disease (in exposed body parts), social ostracism, and discriminatory attitude have negatively impacted the psychological well-being and quality of life in such patients.^{5,6} The increasing prevalence of dermatophytoses among family members, including newborns and young children, presents a challenge not only for treating pediatricians but also trained dermatologists. Understanding the disease burden in a tertiary care centre (catering to a large catchment area) is crucial due to the associated high morbidity.

This study, emphasizing the demographic, clinical, and microbiological parameters of dermatophytoses in the pediatric population in an Eastern Indian tertiary care teaching hospital, was conducted to address this existing knowledge gap in the literature.

Materials and Methods

This was an institution-based, descriptive, cross-sectional study, conducted at a tertiary care teaching hospital in eastern India over one year (January 2019 to March 2020) after Institutional Ethics Committee clearance and in accordance with Good Clinical Practices and Helsinki's Declaration. The sample size was derived with the help of the OpenEpi software (OpenEpi, Atlanta, USA) after taking the reference frequency value from another study.⁷ Consecutive 200 pediatric patients, aged less than 14 years, attending the dermatology OPD directly or referred from other departments, clinically diagnosed (by two dermatologists independently) with dermatophytosis, followed by microbiological confirmation, were recruited in the study (after informed and written consent from the guardian). All recruited patients underwent a thorough history (with special emphasis on socio-demographic profile and past treatment history). Clinical examination, routine biochemical investigations, and microbiological evaluation were done.

Microbiological assessment: In all cases, skin scrapings were collected from the edge of the lesion/ plucked hair/ nail clipping with a sterile scalpel after the affected areas (most representative and accessible site as determined by the treating dermatologist) were decontaminated with 70% alcohol. These specimens were taken on a clean, grease-free slide and mounted in 10-30% potassium hydroxide (KOH) to be examined under a light microscope for fungal elements after 5-10 minutes. All the samples were subjected to KOH preparation for a direct microscopic examination. Three drops of 10% KOH plus 40% dimethyl sulfoxide were placed over a clean, grease-free slide with skin scraping samples placed on that and covered with a coverslip. Slides were

examined in light microscopy, and hyaline branching septate hyphae and arthrospores were identified. For fungal culture, the isolates were grown on 4% Sabouraud's Dextrose agar with chloramphenicol and cycloheximide slant tubes and dermatophyte test media. Incubation was done aerobically at 37 °C (for isolation of *T. verrucosum*) and at 28 °C for other dermatophytes. Cultures were observed, every alternate day, to check for the appearance of any fungal growth or production of any pigment over the reverse side of the slant. Lactophenol cotton blue (LCB) staining was done of smears from culture-positive slants to detect the presence of macro and microconidia. SDA slants were inspected for up to 4 weeks for growth. Culture was identified on the basis of its macro and microscopic features with LCB staining and urease test. The final diagnosis was confirmed by the positivity of the direct smear and culture.

Statistical Analysis

Data were recorded in a clinical record form and entered into an MS Excel worksheet, and descriptive statistical analysis was done by SPSS for Windows (version 13.0, Chicago, IL). Digital photographs were taken by a digital image recorder on the first visit.

Results

Demography

Among 200 patients, the majority (31%) belonged to the 9 to <14 years age group, followed by the pre-school age group (23%), the toddler stage and the infant stage. There was a male preponderance (56%) with a male: female ratio of 1.27:1. Mean age was 6.1 ± 3.3 years (range 3 months to 13 years). Around two-thirds (65%) of the study population were school-going children. As per the modified Kuppuswamy scale (2020),⁸ a fair number (66.5%) of patients were socioeconomically challenged (belonging to the "lower" and "lower middle" strata of society). A rural background was appreciable in most patients (Table 1).

Relevant history

Chronic and recurrent dermatophytosis was established in 9% of the total patients. Afflicted family members (both recurrent and recent past) were noted in 83.5% of total patients. Prior treatment was received by the majority (85%) of patients. More than half (53.5%) of patients reported using over-the-counter topical steroid-laced preparations. Systemic antifungal (often at adult dosage) was noted in 19 (9.5%) patients. The majority had been treated by a pediatrician (34%), followed by quacks (19.5%), and self-medication by guardian/parents (18%).

Clinical findings

Disease duration ranged from 4 days to 18 months (mean: 111.93 ± 28.52 days). About one-third of patients (34.5%) had 5/or more lesions. We observed at least one lesion measuring >10 cm in 22.5%, with a mean size of $7.19 \text{ cm} \pm$ (range from 2 to 62 cm).

Table 1. Characteristics of study population

Parameters	Frequency	Percentage
Age group (years)		
0 ≤1	19	9.5
1 ≤3	31	15.5
3 ≤6	46	23.0
6 ≤9	43	21.5
9 ≤14	61	30.5
Sex		
Male	112	56
Female	88	44
Residence		
Semi-urban	96	48
Urban	73	36.5
Rural	31	15.5
Socioeconomic status		
Lower	78	39
Upper lower	55	27.5
Lower middle	48	24
Upper middle	18	9
Upper	1	0.5
Family members affected		
Yes	167	83.5
No	33	16.5
Past history of similar illness		
Yes	18	9
No	182	91
Treatment history		
Treatment naïve	30	15
OTC steroid-antifungal creams	107	53.5
Topical antifungal	61	30.5
Systemic antifungal	19	9.5
Others	2	1
Physician consultation		
None	30	15
Self-medication	36	18
Quacks	39	19.5
Pediatrician	68	34
Dermatologist	27	13.5
Comorbidities		
None	188	94
Nutritional deficiency	12	6
Iatrogenic Cushings	2	1
Ventricular septal defect	1	0.5
Duration (months)		
<1	35	17.5
1 ≤3	56	28
3 ≤6	83	41.5
6 ≤12	20	10
≥12	6	3
Number of lesions		
<5	131	65.5
≥5 – 10	62	31
>10	7	3.5
Size of largest lesion (cm)		
<10	155	77.5
≥10	45	22.5

Table 1. Continued

Parameters	Frequency	Percentage
Sites affected		
Face + scalp	31	15.5
Axilla	23	11.5
Torso	146	73
Upper limbs	35	17.5
Lower limbs	41	20.5
Groin and genitalia	62	31
Acral areas including nails	10	5
Clinical diagnosis		
Tinea corporis	184	92
Tinea faciei	28	14
Tinea capitis	16	8
Tinea cruris	62	31
Tinea manuum	10	5
Tinea unguium	2	1
Erythroderma	3	1.5
Fungal isolate (*n=184)		
Trichophyton mentagrophytes	146	79.3
Trichophyton rubrum	29	15.8
Epidermophyton	8	4.3
Microsporum	1	0.6

The most common site of involvement was the torso (73%), followed by groin and genitalia (31%), lower limbs (20.5%), and others. The mean body surface area involved was 9.57% (range 1-40%). The most common clinical presentation was tinea corporis (92%), followed by tinea cruris (31%), tinea faciei (14%), and tinea capitis (8%), amongst others. The pattern of tinea pseudoimbricata (ring-within-ring) was appreciated in 58% of patients (Figure 1-4).

Microbiological Findings

KOH mount staining showed long, branching septate hyphae in 184 cases (92%). On fungal culture, the most isolated was *T. mentagrophytes* (79.3%), followed by *T. rubrum* (15.8%), *Epidermophyton* (4.3%), and *Microsporum* (0.6%) (Figure 5).

Discussion

Over the past decade, India has been plagued by the menace of superficial dermatophytosis. This difficult-to-treat problem has emerged as a major public health problem, with increased prevalence of altered clinical forms like chronic, recurrent, recalcitrant, and erythrodermic varieties^{9,10}. In our study, we documented 200 evaluable cases of pediatric dermatophytosis.

Male preponderance is seen among the children, as in adults. Similar to our findings, sex ratio has been documented to range from 1.27:1 to 1.8:1 in different studies¹¹⁻¹⁵. Age group 9-13 years (31%) was found to be most affected by the condition in our study. Data on dermatophytosis involving pediatric cohorts suggests the age group between 11 and 16 years to be commonly affected (Table 2)¹¹⁻¹⁵. Work conducted on chronic and recurrent dermatophytosis by Zacharia and Kunjukunju¹⁶ and Sharma et al.¹⁷ reported 18% and 33.3% of the study group to be students, respectively^{11,12}. A study conducted by Kar et al.¹⁸ in a neonatal care set-up reported tinea corporis in 10.2% and tinea faciei in 1.8% of admitted neonates. In recent studies, infants and toddlers constituted 8.9-11.48% of the pediatric study group^{11,13}.



Figure 1. Tinea cruris in an infant

In congruence, our study found infants to comprise 9.5% of the study population. Dermatophytosis of the glabrous skin observed in neonates and infants speaks volumes of the gravity of the current epidemic-like scenario of dermatophytosis in India.

Various studies on dermatophytosis in children have documented the contact history with infected family members or close contacts to range from 62.2% to 91.9%, with mothers being the primary contact source in young children¹¹⁻¹⁵. We observed an alarmingly high (86%) positive history of contact with affected family members. Sharing of fomites with the infected family members or close contacts, use of tight synthetic garments such as jeans and leggings, synthetic uniforms and track pants, poor personal hygiene, increased physical activity and overcrowding result in a perfect milieu for the multiplication of dermatophytes, especially among adolescents.

In recent years, the use of topical steroid creams, either alone or in combination with antifungal and antibacterial components, procured over the counter or as per prescription, in children has become a very common but alarming phenomenon. Around half (53.5%) of individuals mentioned the usage of steroid-laced preparations in our study. Studies have documented the abuse of TCS creams in children to be in the range of 51% to 94%¹³⁻¹⁵.

The shift in the etiological agent from the more common *T. rubrum* to the virulent *T. mentagrophytes* complex observed among the adults has not spared children. Clinico-mycological studies on pediatric dermatophytosis conducted by Poojary et al.¹⁵ and Ray et al.¹¹ revealed *Trichophyton mentagrophytes* complex to be the predominant etiological agent (73.7% and 73.18%, respectively). *Trichophyton mentagrophytes* complex was the most common isolate in our study, with a slightly higher prevalence (79.3%).

In the past, dermatophytosis in children was almost synonymous with tinea capitis. Similar to recent trends, we found multisite involvement with affection of the torso (73%) and genitalia (31%) as common findings. Clinically, tinea corporis was the most predominant (92%) diagnosis. Myriad morphologies of tinea corporis have been described, like polycyclic lesions, annular, eczematous/erythematous/psoriasiform



Figure 2. Cushingoid habitus in erythrodermic dermatophytosis



Figure 3. Steroid-modified tinea faciei showing multiple concentric rings (tinea pseudoimbricata)



Figure 4. Irritant contact dermatitis from home remedies superimposed on tinea corporis

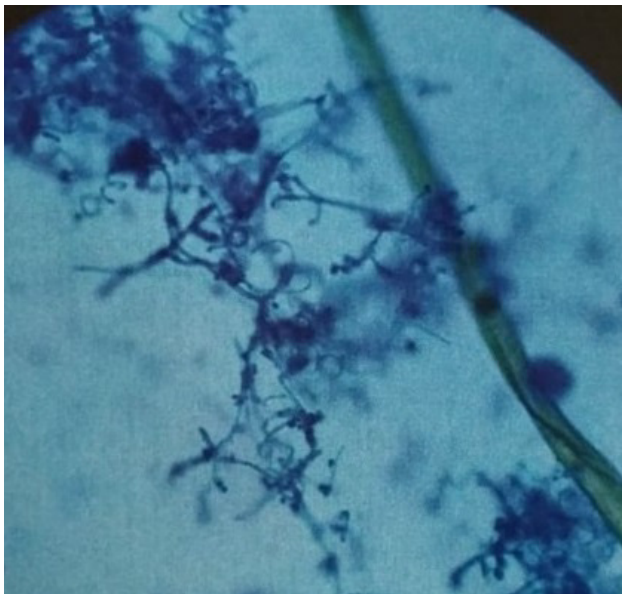


Figure 5. Lactophenol cotton blue (LCB) mount showing septate hyphae with numerous spherical microconidia arranged in grape-like clusters, cigar-shaped macroconidia, and spiral hyphae

lesions, pustules, tinea pseudoimbricata, tinea incognito, and tinea recidivans^{9,15}. While there has been an increase in the prevalence of tinea faciei, surprisingly, there is a decreasing trend of tinea capitis in the recent studies on pediatric dermatophytosis¹⁹. A pertinent observation in our study was the large proportion of children (58%) presenting with ring with ring pattern (pseudoimbricata) and some cases of erythrodermic variant (1%). Prior usage of topical steroids,

Table 2. Comparative analysis with other published Indian studies

Study/year (references)	Sample size	Study location	Study age group (yrs)	Age group commonly affected (%) /mean age (yrs)	Sex ratio	Positive family / contact history (%)	Treatment naïve (%)	Steroid usage (%)	Multisite involved (%)	Clinical diagnoses (%)	Fungal isolate (%) positivity
Dash et al. ¹² 2017	198	Orissa	2-15	11-15 (51.5%) / NM	1.13:1	83.8	NM	-	16.2	Tinea cruris (50), Tinea corporis (47.47)	NS
Mishra et al. ¹³ 2018	235	Uttar Pradesh	<18	>6 - 9 (31.5%) / 7.7 ± 4.74	1.8:1	91.9	NM	94	27.2	Tinea corporis (45.5), Tinea cruris (29.4), Tinea faciei (24.3)	T. mentagrophytes (49)
Gandhi et al. ¹⁴ 2019	100	Karnataka	≤18	10-14 (56%) / NM	1.27:1	83%	32	51	NS	Tinea corporis (45), Tinea cruris (28), Tinea capitis (11)	NS
Poojary et al. ¹⁵ 2021	67	Maharashtra	<14	NS / 6.2 ± 4.3	1.68:1	76.1	11.9	85	52.2	Tinea corporis (73.1), Tinea cruris (55.2), Tinea faciei (17.9)	T. mentagrophytes (73.7)
Ray et al. ¹¹ 2022	183	Orissa	<16	11-16 (47.5) / 9.5	1.22:1	62.2	NM	NS	55.2	Tinea corporis > Tinea cruris > Tinea faciei	T. mentagrophytes / interdigitale (73.18)
Our study	200	West Bengal	<14	3-6 years (44.5%)	1.27:1	83.5	15	53.5	64	Tinea corporis (92), Tinea cruris (31), Tinea faciei (14)	T. mentagrophytes (79.3)

Ref: Reference number; NM: Not mentioned; NS: Not studied, yrs: Years

unfortunately, was the attributable factor (Cushingoid features were observed in 2 patients).

In recent years, there has been an increasing spate of antifungal-resistant dermatophyte infections across the globe²⁰. Although this resistance was initially noted in India, similar observations have now been reported across many parts of Europe, Iran, Japan, China, and more recently in the United States^{21,22}. The predominant causative dermatophyte for these infections has been reported to be *T. mentagrophytes* genotype VIII, recently designated *T. indotineae*²². This fungal pathogen is responsible for chronic, recurrent, recalcitrant and widespread superficial infections. Resistance to terbinafine is frequently encountered and is related to point mutations in the gene encoding the squalene epoxidase²³.

Study Limitations

An important limitation in our study was our inability to assess the antifungal sensitivity pattern of isolates and carry out molecular studies due to resource constraints. Our hospital-based study carried out in a densely populated city in eastern part of eastern India may not be representative of the diverse clinico-mycological shift in other geographical regions.

Conclusion

Our study highlights the evolving trend in demographic profile and clinical features of childhood dermatophytosis in a part of Eastern India. The presence of a positive family history or close contact with an affected family member acts as an important source of pediatric affliction. Strict measures should be taken to discourage the use of over-the-counter topical medications. Education of the masses regarding seeking proper medical care by qualified personnel and maintaining hygiene in daily life is crucial. Further studies should be undertaken, particularly to explore whether there is any correlation between changing clinical patterns of presentation and species of fungal infection and rising antifungal unresponsiveness.

Ethics

Ethics Committee Approval: This was an institution-based, descriptive, cross-sectional study, conducted at a tertiary care teaching hospital in Eastern India over one year (January 2019 to March 2020) after Institutional Ethics Committee clearance and in accordance with Good Clinical Practices and Helsinki's Declaration.

Informed Consent: Written informed consent was obtained from all subjects included in this study including the use of their personal information and photographs to be printed for publication in a journal.

Footnotes

Authorship Contributions

Surgical and Medical Practices: A.B., A.S., L.G., Concept: A.B., A.S., L.G., Design: A.B., A.S., L.G., Data Collection or Processing: A.B., A.S., L.G., Analysis or Interpretation: A.B., A.S., L.G., Literature Search: A.B., A.S., L.G., Writing: A.B., A.S., L.G.

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References

- Verma SB, Panda S, Nenoff P, et al.: The unprecedented epidemic-like scenario of dermatophytosis in India: I. Epidemiology, risk factors and clinical features. *Indian J Dermatol Venereol Leprol.* 2021;87:154-75.
- Panda S, Verma S: The menace of dermatophytosis in India: The evidence that we need. *Indian J Dermatol Venereol Leprol.* 2017;83:281-4.
- Kumar S, Goyal A, Gupta YK: Abuse of topical corticosteroids in India: Concerns and the way forward. *J Pharmacol Pharmacother.* 2016;7:1-5.
- Kanafani ZA, Perfect JR: Antimicrobial resistance: resistance to antifungal agents: mechanisms and clinical impact. *Clin Infect Dis.* 2008;46:120-8.
- Das A, Fatima F, Sil A, Podder I, Jafferany M: Therapeutic management of psychological morbidity and impaired quality of life in patients with persistent dermatophytoses. *Dermatol Ther.* 2020;33:e14124.
- Das A, Sil A, Fatima F, Podder I, Jafferany M: Impact of chronic and recurrent dermatophytosis on quality of life and psychologic morbidity-a cross-sectional study. *J Cosmet Dermatol.* 2022;21:3586-92.
- Nagarajan K, Thokchom NS, Ibochouba K, Verma K, Bishurul Hafi NA: Pattern of pediatric dermatoses in Northeast India *Indian J Paediatr Dermatol.* 2017;18:286-91.
- Ananthan VA: Modified Kuppuswamy scale for socioeconomic status of the Indian family- Update based on New CPI (IW) series from September 2020. *J Family Med Prim Care.* 2021;10:2048-9.
- Dogra S, Narang T: Emerging atypical and unusual presentations of dermatophytosis in India. *Clin Dermatol Rev.* 2017;1:12-8.
- Das A, Sil A, Jaiswal S, et al.: Erythrodermic dermatophytosis: an alarming consequence of steroid abuse and misuse. A multicentre prospective study from India. *Clin Exp Dermatol.* 2022;47:1735-8.
- Ray A, Singh BS, Kar BR: Clinicomycological profile of pediatric dermatophytoses: an observational study. *Indian Dermatol Online J.* 2022;13:361-5.
- Dash M, Panda M, Patro N, Mohapatra M: Sociodemographic profile and pattern of superficial dermatophytic infections among pediatric population in a tertiary care teaching hospital in Odisha. *Indian J Paediatr Dermatol.* 2017;18:191-5.
- Mishra N, Rastogi MK, Gahalaut P, Yadav S, Srivastava N, Aggarwal A.: Clinicomycological study of dermatophytoses in children presenting at a tertiary care center. *Indian J Paediatr Dermatol.* 2018;19:326-30.
- Gandhi S, Patil S, Patil S, Badad A.: Clinicoepidemiological study of dermatophyte infections in pediatric age group at a tertiary hospital in Karnataka. *Indian J Paediatr Dermatol.* 2019;20:52-6.
- Poojary S, Jaiswal S, Bhalala KB, et al.: A cross sectional observational study of pediatric dermatophytosis: Changing clinico mycological patterns in Western India. *Indian J Paediatr Dermatol.* 2021;22:236-40.
- Zacharia M, Kunjukunju BP: Clinical profile of patients with chronic dermatophytosis-A descriptive study from a tertiary care centre in Kerala. *J Evid Based Med Healthc.* 2017;4:2863-6.
- Sharma R, Adhikari L, Sharma RL: Recurrent dermatophytosis:A rising problem in Sikkim, a Himalayan state of India. *Indian J Pathol Microbiol.* 2017;60:541-5.
- Kar C, Sardar SK: Pattern of pathological cutaneous lesions of neonates in neonatal care unit of a peripheral tertiary institution in West Bengal. *Indian J Paediatr Dermatol.* 2019;21:22-30.
- Rengasamy M: The changing scenario of dermatophytosis in children. *Indian Dermatol Online J.* 2022;13:305-9.
- Kruithoff C, Gamal A, McCormick TS, Ghannoum MA: Dermatophyte infections worldwide: increase in incidence and associated antifungal resistance. *Life (Basel).* 2023;14:1.
- Hiruma J, Noguchi H, Hase M, et al.: Epidemiological study of terbinafine-resistant dermatophytes isolated from Japanese patients. *J Dermatol.* 2021;48:564-7.
- Chen E, Ghannoum M, Elewski BE: Treatment-resistant tinea corporis, a potential public health issue. *Br J Dermatol.* 2021;184:164-5.
- Das A, Sil A, Verma SB, Kumar S: Tinea pseudombricata: observations from a clinicoepidemiological and mycological study from eastern India. *Clin Exp Dermatol.* 2022;47:147-9.