

The Incidences of Dermatophytosis and Cutaneous Candidiasis Infection in Southeastern Korea between 2013 and 2016

Weon Ju Lee^{1†}, Dong Hyuk Eun¹, Yong Hyun Jang¹, Yong Jun Bang² and Jae Bok Jun²

¹Department of Dermatology, School of Medicine, Kyungpook National University, Daegu, Korea

²Institute of Medical Mycology, Catholic Skin Clinic, Daegu, Korea

Background: Superficial fungal infections, including dermatophyte infection and cutaneous candidiasis, are common and affect more than 25% of the population worldwide.

Objective: The aim of this study was to investigate the recent clinical and mycological characteristics of dermatophytosis and cutaneous candidiasis in southeastern Korea.

Methods: Of 20,413 patients with dermatophyte infection, cutaneous candidiasis, or suspected fungal infection, 8,106 who were culture positive for infection were retrospectively evaluated using their medical records.

Results: The annual incidence rate of fungal infection tended to be constant. Such infections were more common in men than in women. Fungal infections most commonly occurred in patients in their 50s and in August. The most common clinical type of superficial fungal infections was tinea pedis. The most common causative fungus of superficial fungal infections was *Trichophyton rubrum*.

Conclusion: This study provides useful information on the clinical and mycological characteristics of fungal infections in southeastern Korea in recent years.

Key Words: Candidiasis, Dermatophytosis

INTRODUCTION

Dermatophyte infection and cutaneous candidiasis are common and affect more than 25% of the population worldwide¹. The main causative fungus of superficial mycoses has been changing dramatically in Korea^{2–8}. Several factors such as socioeconomic status, lifestyle, and development of new antifungal drugs lead to changes in the main causative der-

matophyte of superficial mycoses. *Trichophyton (T.) rubrum* is the most common causative agent of dermatophytosis in Korea since the 1960s². *T. mentagrophytes*, *Microsporum (M.) canis*, *T. verrucosum*, *M. gypseum*, and *T. tonsurans* appeared as the main species of superficial mycoses in Korea during the past 100 years^{9–18}. With the development of antifungal agents, an increasing number of patients have visited dermatologic clinics for appropriate treatment of dermatophytosis.

Received: August 13, 2017 Revised: January 9, 2018 Accepted: February 12, 2018

†Corresponding: Weon Ju Lee, Department of Dermatology, Kyungpook National University Hospital, 130 Dongdeok-ro, Jung-gu, Daegu, 41944, Korea.

Phone: +82-10-7730-8877, Fax: +82-53-426-0770, e-mail: weonju@knu.ac.kr

Copyright©2018 by The Korean Society for Medical Mycology. All rights reserved.

©This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. <http://www.ksmm.org>

However, only few recent domestic studies on fungal infections have been reported since 2013, while epidemiological studies are still being reported in various countries. The aim of this study was to investigate the clinical and mycological characteristics of dermatophytosis and cutaneous candidiasis in southeastern Korea in recent years.

MATERIALS AND METHODS

1. Patients and methods

The medical records of 20,413 patients with dermatophyte infection or cutaneous candidiasis were retrospectively studied. The medical records were recorded at Kyungpook National University Hospital or the Catholic Skin Disease Clinic from

2013 to 2016. The patients were KOH- and/or culture positive. Most of the patients had lived in the southeastern area of South Korea.

The presence of dermatophytes and *Candida* was identified using KOH examination and fungal culture. Specimens for fungal examinations were obtained by scraping the lesions with a scalpel, and microscopic examination with 15% KOH solution was performed. Among the 20,413 patients, 13,441 (66%) were KOH positive. Diagnoses of dermatophyte and *Candida* infections were confirmed with fungal culture using potato cornmeal Tween 80 agar culture media. The culture media were kept at 24~26°C for over 2 weeks. Dermatophytes and *Candida* on the culture media each showed a morphologically typical colony. Among the 20,413 patients, 8,106 (40%) were culture positive. The medical records of the culture-positive patients were used to evaluate the annual

Table 1. Distribution of dermatophyte and cutaneous *Candida* infections according to sex and age

	0~9 years	10~19 years	20~29 years	30~39 years	40~49 years	50~59 years	60~69 years	70~79 years	≥80 years	Total
Male	110 (66.7%)	251 (72.8%)	584 (75.4%)	948 (73.0%)	1,113 (65.9%)	1,135 (60.5%)	638 (56.7%)	258 (41.2%)	64 (30.9%)	5,101 (62.9%)
Female	55 (33.3%)	94 (27.2%)	191 (24.6%)	351 (27.0%)	576 (34.1%)	740 (39.5%)	487 (43.3%)	368 (58.8%)	143 (69.1%)	3,005 (37.1%)
Total	165 (2.0%)	345 (4.3%)	775 (9.6%)	1,299 (16.0%)	1,689 (20.8%)	1,875 (23.1%)	1,125 (13.9%)	626 (7.7%)	207 (2.6%)	8,106 (100%)

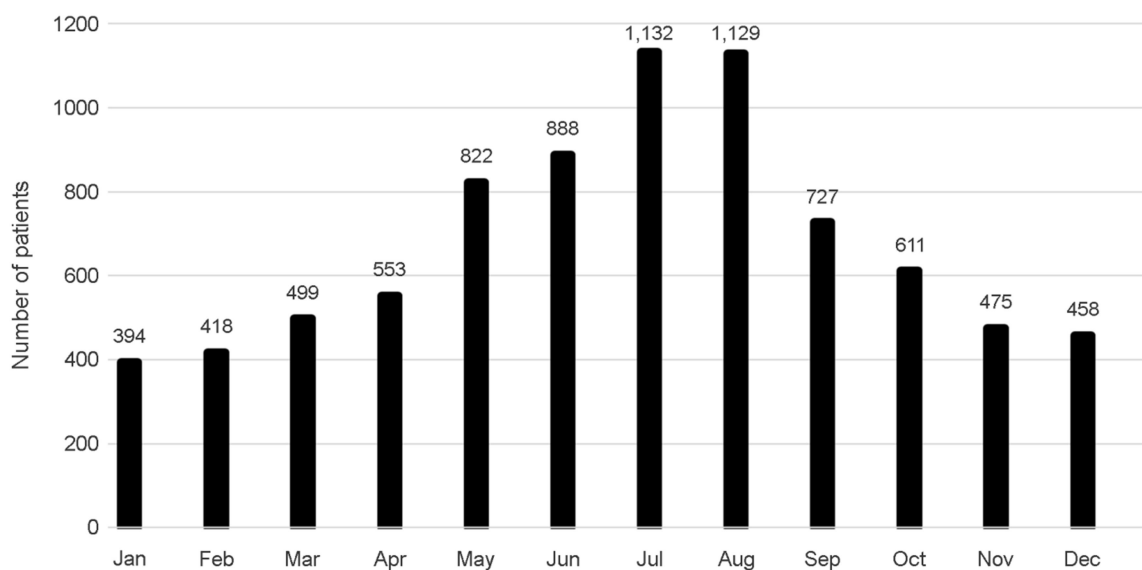


Fig. 1. Monthly distributions of dermatophyte and cutaneous *Candida* infections

Table 2. Topographical distribution according to sex

	Tinea manus	Tinea pedis	Tinea unguium	Tinea capitis	Tinea faciei	Tinea corporis	Tinea cruris	Other
Male	106 (63.9%)	2,556 (65.6%)	1,329 (55.6%)	14 (29.2%)	90 (59.6%)	169 (47.7%)	820 (77.6%)	17 (39.5%)
Female	60 (36.1%)	1,342 (34.4%)	1,060 (44.4%)	34 (70.8%)	61 (40.4%)	185 (52.3%)	237 (22.4%)	26 (60.5%)
Total	166 (2.0%)	3,898 (48.1%)	2,389 (29.5%)	48 (0.6%)	151 (1.9%)	354 (4.4%)	1,057 (13.0%)	43 (0.5%)

Table 3. Topographical distribution according to age

Age, years	Tinea manus	Tinea pedis	Tinea unguium	Tinea capitis	Tinea faciei	Tinea corporis	Tinea cruris	Other
0~9	6 (3.6%)	84 (2.2%)	8 (0.3%)	21 (43.8%)	16 (10.6%)	16 (4.5%)	12 (1.1%)	2 (4.7%)
10~19	5 (3.0%)	176 (4.5%)	19 (0.8%)	6 (12.5%)	10 (6.6%)	45 (12.7%)	84 (7.9%)	0
20~29	10 (6.0%)	424 (10.9%)	146 (6.1%)	1 (2.1%)	9 (6.0%)	43 (12.1%)	139 (13.2%)	3 (7.0%)
30~39	18 (10.8%)	787 (20.2%)	285 (11.9%)	1 (2.1%)	11 (7.3%)	39 (11.0%)	157 (14.9%)	1 (2.3%)
40~49	38 (22.9%)	911 (23.4%)	490 (20.5%)	1 (2.1%)	16 (10.6%)	44 (12.4%)	186 (17.6%)	3 (7.0%)
50~59	31 (18.7%)	856 (22.0%)	671 (28.1%)	1 (2.1%)	35 (23.2%)	58 (16.4%)	214 (20.2%)	9 (20.9%)
60~69	36 (21.7%)	426 (10.9%)	436 (18.3%)	2 (4.2%)	26 (17.2%)	46 (13.0%)	151 (14.3%)	2 (4.7%)
70~79	16 (9.6%)	189 (4.8%)	256 (10.7%)	8 (16.7%)	20 (13.2%)	35 (9.9%)	88 (8.3%)	14 (32.6%)
80~89	6 (3.6%)	45 (1.2%)	78 (3.3%)	7 (14.6%)	8 (5.3%)	28 (7.9%)	26 (2.5%)	9 (20.9%)
Total	166 (2.0%)	3,898 (48.1%)	2,389 (29.5%)	48 (0.6%)	151 (1.9%)	354 (4.4%)	1,057 (13.0%)	43 (0.5%)

incidence and patient distribution according to sex, age, season, site, and causative fungus. Tinea pedis was designated as superficial fungal infection of the toe web, sole, and dorsum of the foot. Onychomycosis was defined as superficial fungal infection of the toenail and fingernail. Tinea corporis was designated as a superficial fungal infection of the neck, chest, back, abdomen, axilla, upper and lower extremities, and buttocks. Tinea manus was defined as a superficial fungal infection of the palm, finger web, and dorsum of the hand.

RESULTS

1. Annual incidence rates of dermatophyte and cutaneous *Candida* infections

The annual incidence rates of dermatophyte and cutaneous *Candida* infections were as follows: 2,029 in 2013, 1,841 in 2014, 1,799 in 2015, and 2,427 in 2016.

Table 4. Sexual distribution of causative fungi

	<i>T. rubrum</i>	<i>T. mentagrophytes</i>	<i>T. verrucosum</i>	<i>T. tonsurans</i>	<i>M. canis</i>	<i>M. gypseum</i>	<i>E. floccosum</i>	<i>C. albicans</i>
Male	4,706 (64.2%)	194 (59.7%)	1 (25.0%)	14 (82.4%)	25 (23.4%)	4 (57.1%)	7 (100%)	151 (49.2%)
Female	2,626 (35.8%)	131 (40.3%)	3 (75.0%)	3 (17.6%)	82 (76.6%)	3 (42.9%)	0	156 (50.8%)
Total	7,332 (90.5%)	325 (4.0%)	4 (0%)	17 (0.2%)	107 (1.3%)	7 (0.1%)	7 (0.1%)	307 (3.8%)

T.: Trichophyton, *M.*: Microsporum, *E.*: Epidermophyton, *C.*: Candida

Table 5. Age distribution of the patients according to causative fungus

Age, years	<i>T. rubrum</i>	<i>T. mentagrophytes</i>	<i>T. verrucosum</i>	<i>T. tonsurans</i>	<i>M. canis</i>	<i>M. gypseum</i>	<i>E. floccosum</i>	<i>C. albicans</i>
0~9	119 (1.6%)	9 (2.8%)	1 (25.0%)	0	27 (25.2%)	1 (14.3%)	0	8 (2.6%)
10~19	295 (4.0%)	9 (2.8%)	0	14 (82.4%)	22 (20.6%)	0	0	5 (1.6%)
20~29	700 (9.5%)	38 (11.7%)	0	3 (17.6%)	16 (15.0%)	0	2 (28.6%)	16 (5.2%)
30~39	1,199 (16.4%)	57 (17.6%)	2 (50.0%)	0	13 (12.1%)	2 (28.6%)	0	26 (8.5%)
40~49	1,565 (21.4%)	79 (24.4%)	0	0	4 (3.7%)	2 (28.6%)	1 (14.3%)	38 (12.4%)
50~59	1,713 (23.4%)	70 (21.5%)	0	0	5 (4.7%)	0	3 (42.9%)	84 (27.4%)
60~69	1,013 (13.8%)	40 (12.3%)	1 (25.0%)	0	6 (5.6%)	1 (14.3%)	1 (14.3%)	63 (20.5%)
70~79	550 (7.5%)	17 (5.2%)	0	0	11 (10.3%)	0	0	48 (15.6%)
≥80	178 (2.4%)	6 (1.9%)	0	0	3 (2.8%)	1 (14.3%)	0	19 (6.2%)
Total	7,332 (90.5%)	325 (4.0%)	4 (0%)	17 (0.2%)	107 (1.3%)	7 (0.1%)	7 (0.1%)	307 (3.8%)

T.: Trichophyton, *M.*: Microsporum, *E.*: Epidermophyton, *C.*: Candida

2. Distributions of dermatophyte and cutaneous *Candida* infections according to sex and age

Of 8,106 culture-positive patients, 5,101 (62.9%) were men and 3,005 (37.1%) were women (Table 1). However, the group aged ≥70 years had more women than men (Table 1). The most common age group was the 50s group (1,875; 23.1%), followed by the 40s (1,689; 20.8%) and 30s groups (1,299; 16.0%; Table 1).

3. Monthly distributions of dermatophyte and cutaneous *Candida* infections

The incidence rates of dermatophyte and cutaneous *Candida* infections were highest in July, followed by August and June (Fig. 1). Of 8,106 culture-positive patients, 1,132 (14.0%) were diagnosed in July, 1,129 (13.9%) in August, and 888 (11.0%) in June (Fig. 1).

Table 6. Monthly distribution of causative fungi

	<i>T. rubrum</i>	<i>T. mentagrophytes</i>	<i>T. verrucosum</i>	<i>T. tonsurans</i>	<i>M. canis</i>	<i>M. gypseum</i>	<i>E. floccosum</i>	<i>C. albicans</i>
Jan	355 (4.8%)	15 (4.6%)	1 (25.0%)	2 (11.8%)	10 (9.3%)	0	0	11 (3.6%)
Feb	383 (5.2%)	11 (3.4%)	0	2 (11.8%)	2 (1.9%)	2 (28.6%)	0	18 (5.9%)
Mar	454 (6.2%)	22 (6.8%)	0	0	7 (6.5%)	0	0	16 (5.2%)
Apr	487 (6.6%)	28 (8.6%)	0	6 (35.3%)	7 (6.5%)	0	0	25 (8.1%)
May	737 (10.1%)	48 (14.8%)	0	1 (5.9%)	12 (11.2%)	0	2 (28.6%)	22 (7.2%)
Jun	819 (11.2%)	33 (10.2%)	2 (50.0%)	1 (5.9%)	8 (7.5%)	2 (28.6%)	2 (28.6%)	21 (6.8%)
Jul	1,034 (14.1%)	53 (16.3%)	0	0	4 (3.7%)	2 (28.6%)	2 (28.6%)	37 (12.1%)
Aug	1,023 (14.0%)	39 (12.0%)	0	0	15 (14.0%)	0	0	52 (16.9%)
Sep	653 (8.9%)	30 (9.2%)	1 (25.0%)	1 (5.9%)	9 (8.4%)	0	0	33 (10.7%)
Oct	551 (7.5%)	16 (4.9%)	0	0	9 (8.4%)	0	0	35 (11.4%)
Nov	424 (5.8%)	15 (4.6%)	0	3 (17.6%)	12 (11.2%)	1 (14.3%)	0	20 (6.5%)
Dec	412 (5.6%)	15 (4.6%)	0	1 (5.9%)	12 (11.2%)	0	1 (14.3%)	17 (5.5%)
Total	7,332 (90.5%)	325 (4.0%)	4 (0%)	17 (0.2%)	107 (1.3%)	7 (0.1%)	7 (0.1%)	307 (3.8%)

T.: *Trichophyton*, *M.*: *Microsporum*, *E.*: *Epidermophyton*, *C.*: *Candida*

4. Topographical distributions of dermatophyte and cutaneous *Candida* infections

The most common clinical type of dermatophyte and cutaneous *Candida* infections was tinea pedis (3,898; 48.1%), followed by tinea unguium (2,389; 29.5%) and tinea cruris (1,057; 13.0%) (Table 2). Tinea capitis was more common in women than in men (Table 2). In addition, tinea capitis was most common at the age of ≤9 years, followed by the 70s and 80s and older (Table 3). Tinea cruris was less common in women than in men (Table 3).

5. Distribution of causative fungi

The most common fungal strain was *T. rubrum* (7,332;

90.4%), followed by *T. mentagrophytes* (325; 4.0%) and *Candida albicans* (307; 3.8%) (Table 4). Most fungal infections, including *T. rubrum* infection, were more common in men, while *M. canis* infection was more common in women (Table 4). *T. tonsurans* infection only occurred in the 10s and 20s age groups. *M. canis* infection was most common in the ≤9-year age group. *C. albicans* infection was more common in the elderly group, including the 50s, 60s, and 70s age groups (Table 5). Most fungal infections were more in summer, but *M. canis* and *T. tonsurans* infections did not show monthly preponderance (Table 6). *T. rubrum* and *T. mentagrophytes* infections were the major causes of tinea pedis (Table 7). *M. canis* and *T. tonsurans* infections usually caused tinea faciei, tinea corporis, and tinea capitis (Table 7). *C. albicans* infection was the major cause of tinea pedis, tinea corporis, and tinea

Table 7. Topographical distribution of causative fungi

	<i>T. rubrum</i>	<i>T. mentagrophytes</i>	<i>T. verrucosum</i>	<i>T. tonsurans</i>	<i>M. canis</i>	<i>M. gypseum</i>	<i>E. floccosum</i>	<i>C. albicans</i>
Tinea manus	145 (1.2%)	5 (1.5%)	0	0	2 (1.9%)	0	0	14 (4.6%)
Tinea pedis	3,569 (48.7%)	209 (64.3%)	0	0	1 (0.9%)	2 (28.6%)	4 (57.1%)	113 (36.8%)
Tinea unguium	2,254 (30.7%)	79 (24.3%)	0	1 (5.9%)	0	3 (42.9%)	2 (28.6%)	50 (16.3%)
Tinea capitis	13 (0.2%)	0	0	3 (17.6%)	32 (29.9%)	0	0	0
Tinea faciei	117 (1.6%)	9 (2.8%)	2 (50%)	4 (23.5%)	18 (16.8%)	0	0	1 (0.3%)
Tinea corporis	259 (3.5%)	16 (4.9%)	1 (25%)	9 (52.9%)	53 (49.5%)	2 (28.6%)	0	14 (4.6%)
Tinea cruris	973 (13.3%)	6 (1.8%)	1 (25%)	0	1 (0.9%)	0	1 (14.3%)	75 (24.4%)
Others	2 (0.0%)	1 (0.3%)	0	0	0	0	0	40 (13.0%)
Total	7,332 (90.5%)	325 (4.0%)	4 (0%)	17 (0.2%)	107 (1.3%)	7 (0.1%)	7 (0.1%)	307 (3.8%)

T.: Trichophyton, *M.*: Microsporium, *E.*: Epidermophyton, *C.*: Candida

unguium (Table 7).

DISCUSSION

The incidence of fungal infection is influenced by lifestyle, hygiene, and accessibility to hospitals. Despite the recent economic developments, the incidence of fungal infection in Korea has been increasing. Fungal infection is generally known to affect more than 25% of the population worldwide¹. This study showed a steady incidence in recent years.

In Korea, dermatophytosis was most common in young adults in the past but in middle-aged adults in recent years. This study also showed that fungal infection was more common in middle-aged individuals. Unusually, fungal infections caused by *M. canis* and *T. tonsurans* developed in young children, like in this study^{19,20}. Unlike previous reports, this study demonstrated that *M. gypseum* infection did not show preponderance in young children¹⁹. However, because the incidence of *M. gypseum* infection was low, we could not draw a definite conclusion. The ratio of men in this study was greater than that in previous reports. In addition, the ≥70-year age group had more women than men.

Superficial fungal infections usually develop in summer because dermatophyte infection of the human skin is accelerated by a hot and humid weather. However, some studies showed that *M. canis* infection had greater incidences in winter than in any other season¹⁹. *T. tonsurans* infection was also found to occur more commonly in spring²⁰. In this study, the seasonal incidences of *M. canis* infection and *T. tonsurans* infections did not show the same patterns as those reported in previous studies.

The most common clinical type of superficial fungal infections was tinea pedis. Tinea pedis is a common dermatophyte infection. Moreover, the incidence of tinea pedis has increased in low socioeconomic countries²¹. In this study, we found that tinea cruris occurred less frequently in women than in men. Macura reported that tinea cruris is commonly found in men living in warm climates²². Tinea cruris can coexist with tinea pedis because dermatophytes spread from the feet to the groin by scratching. Therefore, tinea cruris was the third most common clinical type of dermatophytosis.

The causative species of fungal infections has considerable variability. *T. rubrum* was reported to be a major cause of fungal infections in Europe, whereas *T. mentagrophytes* infection is more common in Asia¹. *T. rubrum* has also been

considered the most common causative agent of dermatophytosis in Korea since the 1960s². Lee et al. reported that 88.35% of patients in Korea had *T. rubrum* infection²³. This study also showed that the most common dermatophyte was *T. rubrum*. *T. rubrum* infection was more common in men, while *M. canis* infection was more common in women. In addition, the predominant species of dermatophytes vary with the clinical type of dermatophytosis. Tinea pedis is usually caused by *T. rubrum*, *T. interdigitale*, and *Epidermophyton (E.) floccosum*. In our study, the major causative agents of tinea pedis were *T. rubrum* and *T. mentagrophytes*. In addition, *C. albicans* was one of the major causes of tinea pedis. Tinea pedis caused by *T. rubrum* seems to be related to exercise, outdoor activity, obesity, diabetes mellitus, and increasing age. Conversely, *M. canis* and *T. tonsurans* usually cause tinea faciei, tinea corporis, and tinea capitis as reported in the literature. Infections caused by *M. canis* could be related to the close contact between humans and contaminated animals. Infection caused by *T. tonsurans* could be associated with frequent international sports activities. Contrary to previous reports, *E. floccosum* was not found as a causative agent of fungal infections. Kim et al. reported that the incidence of *E. floccosum* infection had rapidly decreased in Korea since 1990²⁴.

Fungal infections still exist worldwide. Therefore, we should have awareness on fungal infections. Our results are not significantly different from the previous data but are meaningful in that they show the recent trend of fungal infection, including cutaneous candidiasis. This study provides useful information on the recent clinical and mycological characteristics of fungal infections in the southeastern area of Korea.

CONFLICT OF INTEREST

In relation to this article, I declare that there is no conflict of interest.

REFERENCES

- Havlickova B, Czaika VA, Friedrich M. Epidemiological trends in skin mycoses worldwide. *Mycoses* 2008;51:2-15
- Kim HS. The statistical and mycological survey on superficial dermatomycoses. *Korean J Dermatol* 1971;9:1-4
- Rhim KJ, Kim JH, Shin S. A clinical and mycological study of superficial dermatophytoses. *Korean J Dermatol* 1978;16:435-442
- Min BK, Chung BS, Choi KC, Kim HK. Clinical and mycological studies on dermatophytosis. *Korean J Dermatol* 1984;22:604-609
- Lee HK, Seo SJ, Kim MN, Hong CK, Ro BI. A clinical and mycological study of superficial fungal diseases (vii) *Korean J Dermatol* 1993;31:559-566
- Moon HJ, Lee JB, Kim SJ, Lee SC, Won YH. Clinical and mycological studies on dermatomycosis (1991-2000) *Korean J Med Mycol* 2002;7:78-85
- Lee DK, Moon KC, Koh JK. Clinical and mycological studies on superficial fungal infection. *Korean J Med Mycol* 2006;11:54-63
- Lee YW, Yun SJ, Lee JB, Kim SJ, Lee SC, Won YH. Clinical and mycological studies on dermatomycosis (2001-2010) *Korean J Med Mycol* 2013;18:30-38
- Kim BS, Suh SB. Mycological and clinical observation on dermatophytosis. *Korean J Dermatol* 1976;14:325-334
- Suh SB, Kim SW, Oh SH, Choi SK, Bang YJ. A case of block dot ringworm caused by *Trichophyton tonsurans*. *Korean J Dermatol* 1998;36:918-923
- Sung SY, Kim HY, Kim HU, Ihm CW. *Trichophyton tonsurans* infection in wrestlers and a child. *Korean J Dermatol* 1998;36:732-736
- Kim JC, Choi JS, Kim KH, Suh SB. Mycological features of *Trichophyton verrucosum* isolated in Taegu area. *Korean J Dermatol* 1992;30:761-768
- Kim YP, Chun IK, Kim SH. A case of kerion celsi caused by *Trichophyton verrucosum* and its epidemiologic study. *Korean J Dermatol* 1986;24:687-691
- Jun JB, Suh SB. Clinical and mycological studies on *Microsporum gypseum* infection. *Korean J Dermatol* 1980;18:369-381
- Lee DS, Cho GY, Kim YH, Houh W. A case of tinea capitis due to *Microsporum gypseum*. *Korean J Dermatol* 1984;22:643-646
- Lee H, Lee ES, Kang WH, Lee SN. An unusual clinical manifestation of tinea corporis caused by *Microsporum ferrugineum*. *Korean J Dermatol* 1987;25:383-388
- Kim HU, Choi CJ, Yun SK. Three cases of tinea capitis caused by *Microsporum ferrugineum*. *Korean J Dermatol* 1993;31:760-764
- Kim YA, Lee KH, Lee JB, Suh SB. A case of fungal granuloma caused by *Trichophyton violaceum*. *Korean J Dermatol* 1989;27:304-307
- Lee WJ, Song CH, Lee SJ, Kim DW, Jun JB, Bang YJ. Decreasing prevalence of *Microsporum canis* infection in Korea: through analysis of 944 cases (1993-2009) and review of our previous data (1975-1992). *Mycopathologia* 2012;173:235-239
- Lee WJ, Sim HB, Jang YH, Lee SJ, Kim DW, Jun JB, et al.

- Skin Infection due to *Trichophyton tonsurans* still occurs in people in Korea but not as outbreaks. J Korean Med Sci 2016;31:296-300
21. Nenoff P, Herrmann J, Gräser Y. *Trichophyton mentagrophytes* sive interdigitale? A dermatophyte in the course of time. JDDG 2007;5:198-202
22. Macura AB. Dermatophyte infections. Int J Dermatol. 1993;32:313-323
23. Lee WJ, Kim SL, Jang YH, Lee SJ, Kim DW, Bang YJ. Increasing prevalence of *Trichophyton rubrum* identified through an analysis of 115,846 cases over the last 37 years. J Korean Med Sci 2015;30:639-643
24. Kim SL, Lee KC, Jang YH, Lee SJ, Kim DW, Lee WJ, et al. The epidemiology of dermatophyte infection in southeastern Korea (1979-2013). Ann Dermatol 2016;28:524-527