

Dermatophytes in a Swimming Pool Facility: Difference in Dermatophyte Load in Men's and Women's Dressing Rooms

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Sir,

The frequent dermatophyte infections of swimmer's feet are most likely related to increased exposure to dermatophytes and maceration of skin (1). Fungal particles are shed from infected tissues and found on the floors of shared bathing facilities (2–5). Two studies have revealed a higher level of contamination in men's dressing rooms than in women's (2, 4), and a higher rate of tinea pedis in boys than girls has been reported (6).

In a pilot study of dermatophyte contamination in a swimming pool facility in Reykjavik informal interviews with the swimming pool personnel indicated that the women's area was cleaned more frequently and extensively than the men's area.

The aim of the present study was to confirm the differences observed in dermatophyte contamination between the respective dressing rooms and explore whether they were affected by standardization of cleaning methods.

MATERIALS AND METHODS

The study was conducted in an outdoor swimming pool facility in Reykjavik that receives 500,000–600,000 swimmers annually. The facility is open from 6:50 am to 9:30 pm on weekdays. Swimmers are divided into three age categories: i) <16 years; ii) 16–66 years and iii) >66 years. The indoor facilities examined comprised men's and women's dressing rooms that lead to shower rooms where every swimmer bathes before entering the pool. Men's and women's shower rooms lead to a common corridor, then to the poolside.

The study period included all weekdays throughout a 4-week period in March 1999. Samples were taken twice daily, between 10 and 11 am and 4 and 5 pm. Three floor sites were sampled each time, two in men's and women's dressing rooms areas next to the shower rooms, and one in a common corridor leading from shower rooms to poolside. The floors in dressing rooms and shower rooms are tiled, and the corridor floor is covered with a net-like plastic carpet. Weekly samples from seven sites in dressing rooms, shower rooms and corridor were taken before opening hours.

Dressing rooms and shower rooms were cleaned thoroughly every night by the use of automated machines (dressing rooms) and with water jets and scrubbing (shower rooms). Chlorinated detergents were used in both areas. During opening hours cleaning was carried out by the shower guards, female in the women's area and male in men's area. The shower rooms were flushed with cold water and the dressing rooms were swept with dry, furry cotton mops that were changed daily. Plastic carpets in the corridor were flushed each night; the cleaning procedure and frequency were kept constant during the study. During the first 2 weeks of the study (period 1), the shower guards maintained their usual cleaning methods. The shower rooms were flushed with cold

water every 1–3 hours and in the dressing rooms the floor next to the shower rooms was mopped several times a day in order to keep it dry and non-slippery. The rest of the dressing rooms was mopped 2–4 times a day on the women's side and at least once a day on the men's side. Female personnel claimed that cleaning in the women's area was generally more frequent and more extensive than in the men's area. During the second 2 weeks (period 2), the cleaning routine in men's and women's areas was standardized with regard to method and timing. Female and male members of the personnel flushed the respective shower rooms and mopped the entire dressing rooms at 10 am and 14:15 pm.

Five Rodac[®] plates (25.5 cm²) were used in each site. Each plate contained 16 ml of 4% Sabouraud dextrose agar (Oxoid) with cycloheximide 2 mg/ml, gentamicin 0.05 mg/ml and chloramphenicol 0.5 mg/ml. Sampling was performed by two of the authors (H.H. and A.S.) and the technique was defined a priori. In each site the five Rodac[®] plates were placed randomly over an approximately 250 cm² floor or carpet area and allowed to stand for 5 seconds, without pressing. The Rodac[®] plates were incubated at 30°C for a week, thereafter at 20–22°C for 2 weeks, and examined weekly. All mould-like colonies other than black fungi were subcultured on Mycobiotic[®] medium (Difco) and incubated at 20–22°C for 3 weeks. Dermatophytes were identified to a species level by macroscopic and microscopic characteristics; urease test and thiamine agar were used when necessary. The number of dermatophytes on each plate was recorded and expressed as colony forming units (cfu).

RESULTS

The number of swimmers was 11,103 during the first 2-week period (weekends not included), and 12,582 during the second. Normally, the yearly average male:female ratio is 6:4; during the study period men were 65% of all swimmers. Age distribution in periods 1 and 2 was as follows: i) <16 years old, 8% and 12% respectively; ii) 16–66 years old, 65% and 63%, and iii) >66 years old, 27% and 25%. Information on gender within specific age group was only available for swimmers older than 66 years, 55% of whom were male.

Our findings revealed a remarkably low level of positive cultures in the women's dressing rooms and no change in corridor contamination during the study period (Table I). The total number of dermatophytes in the men's dressing rooms decreased by 12% from period 1 (498 cfu) to period 2 (438 cfu). The reduction was due to low cfu numbers in week 4 and probably not related to modification of cleaning methods. The large number of cfu in morning samples, compared with afternoon samples, in men's dressing rooms probably reflects the heavy use of the facility in the morning; one-third of the

Table I. Number of dermatophyte colony forming unit (cfu) in women's and men's dressing rooms and in corridors

Parameter	Normal cleaning			Standardized cleaning			Median*	Range†
	Week 1	Week 2	Total	Week 3	Week 4	Total		
Women's room	3	6	9	18	1	19	0	0–13
Morning samples	0	0	0	17	0	17	0	0–13
Afternoon samples	3	6	9	1	1	2	0	0–4
Men's room	265	233	498	292	146	438	17	0–84
Morning samples	185	169	354	214	109	323	23,5	10–84
Afternoon samples	80	64	144	78	37	115	12	0–30
Total for corridor	111	64	175	88	109	197	8,5	1–28
Morning samples	56	37	93	61	58	119	9	1–28
Afternoon samples	55	27	82	27	51	78	8	2–20
Total for all sites	379	303	682	398	256	654

*Median of daily number of cfu over 20 days.

†Range of daily number of cfu.

swimmers arrive before 10 am. All early morning samples but two were negative, one cfu was isolated from the exit to the corridor on the women's side and another one from the corridor.

The proportion of plates that contained any number of dermatophyte cfu was 7.5% (15/200), 81% (162/200) and 65.5% (131/200) in the women's dressing room, men's dressing room and corridor, respectively. No change was seen between period 1 and 2. *Trichophyton rubrum* was the commonest species observed (88.6%), followed by *T. mentagrophytes* (10.1%) and *Epidermophyton floccosum* (1.32%).

DISCUSSION

The study revealed a surprisingly large difference in dermatophyte contamination between men's and women's dressing rooms. This difference was maintained after cleaning was standardized to identical methods on both sides. Previous reports have indicated a relationship between dermatophyte load on one hand and the number of swimmers (3, 5) and infection rate on the other (2, 6). Men outnumbered women in our study by a ratio of 6.5:3.5, and were more often infected, as was demonstrated in a recent study on onychomycosis in swimmers attending the pool (7). The infection rate in this study in men and women was 26.2% and 14.5%, respectively, whereas a population-based study indicated a prevalence of 11.1% of onychomycosis in Iceland, with a slightly higher prevalence in males (8).

The high infection rate in male swimmers compared with the general population and the heavy dermatophyte load in their dressing rooms suggest a bidirectional interaction between floor contamination and dermatophyte infections. If this is the case, the incidence of infection might be reduced by the adoption of intensified cleaning and individual measures that prevent dermatophyte shedding or adherence to feet. The

efficacy of cleaning was confirmed in our study where all early morning samples but two were negative. However, due to crowding in the dressing rooms, frequent brooming and flushing during opening hours is not considered practical. Watanabe et al. demonstrated an indirect spread of dermatophytes from an infected individual to healthy ones and showed that wiping and washing the feet was effective in reducing skin contamination (9).

Measures that minimize exposure include treatment of infected individuals, frequent cleaning of floors when possible and the use of slippers in the swimming pool facility.

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