

Fungal Contamination of Indoor Public Swimming Pools, Ahwaz, South-west of Iran

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(Received 17 Mar 2010; accepted 22 Aug 2010)

Abstract

Background: Using public swimming pools during different seasons and poor health behavior could be responsible in transmission of fungal disease through pool water and its environment. Therefore, this research was conducted to investigate fungal agents of indoor public swimming pools of Ahwaz, capital city of Khuzestan Province, south-west of Iran.

Methods: Ten indoor swimming pools of Ahwaz were investigated during two seasons for 6 months. Water specimens were collected by pump and environment samples including shower-bath area, margin of pool walls, dressing rooms, and slippers, by sterile carpet pieces. All specimens were cultured in SC and SCC culture media and fungal agents identification were based on macroscopic, microscopic characteristic and complement tests when it was necessary. Data analyzing was performed using SPSS version 13 for descriptive analyzing.

Results: A total of 593 samples were collected from different parts of pools. Interestingly in 13 samples from environmental places, dermatophytes were isolated as follows: *Trichophyton mentagrophytes*, *T. rubrum*, *T. verrucosum* and *Epidermophyton floccosum* 5, 4, 3 and 1 cases respectively. Ten cases of dermatophytes were isolated from floor of dressing area. Three hundred seventy two saprophytic fungi species and 32 yeasts were recovered from water and environment surfaces samples. *Aspergillus*, *Penicillium* and *Mucor* were the most common isolated saprophytic fungi.

Conclusion: Existence of saprophytic fungi and yeast in pools water seems to be an indicator of their resistance to detergent agents. In addition, yeast water contamination could be from swimmers. Dermatophytes isolation from pools environment areas and foot washing sink, reveals the importance of public swimming pools in disease transmission. Because dressing places are being used by all of the swimmers, take care of hygienic discipline in these places should be noted by health policy markers.

Keywords: Swimming pool, Dermatophytes, Saprophytic fungi, Iran

Introduction

There are growing rates of people attend swimming pools for recreational, rehabilitative treatment or sport, especially in tropical area. Dermatophytosis, which is the most common fungal cutaneous infection, is a communicable disease mainly transmitted by human sources and swimming pools have high potential to transfer this infection. Environmental surfaces of public swimming pools may be contaminated by many species of fungi especially in tropic climates.

Therefore, they could play as one of the most important sources for fungal transmission to the swimmers. Isolation of dermatophytes from public swimming pools have been investigated and reported by a number of investigators (1-13). Existence of pathogenic fungi in environmental public places is still one of the most important transmission key.

Saprophytic fungi and yeast organisms have potential pathogenicity for candidiasis, otomycosis, asthma and allergy (5, 9, 14). Although sus-

ceptible persons may be infected from different places, however, it should be noted that pools environment have their importance role in contribution to spread these agents, especially in subtropical humid climates.

In order to indicate the frequency of fungal contamination and to control and prevent fungal diseases among public pools swimmers, the present study was designed to investigate environmental and water sources of indoor public swimming pools in Ahwaz capital city of Khuzestan Province.

Materials and Methods

Sample collection

Ten indoor public swimming pools of Ahwaz City were investigated during six months (summer and winter). Samples were collected two times per month, first and fifteenth of every month. Water samples were taken from the swimming pools and foot-washing sink.

To neutralize the chlorine residual, sodium thiosulfate was added in the sampling bottles of water collection (15). All samples were transferred to the laboratory, where they were passed through milipore filters with 0.45 μm size. Filters were cultured on Mycosel agar (Sabouraud's dextrose agar with Chloramphenicol and Cyclohexamide) and Sabouraud's dextrose agar. The plates were incubated at 25°C for 3 weeks, and examined at frequent intervals.

Environmental samples were taken from shower-bath area, margin of pool walls, dressing rooms, and slippers, by a piece of steril carpet (size of 4×5 cm²). The piece of carpets were rubbed against the dried surfaces, wrapped in sterile aluminum foil, and transferred to laboratory. Carpet pieces were shaken over the culture media under the sterile condition of biological hood. The plates were incubated as mentioned earlier.

Fungi identification

Isolation and identification of fungi were achieved by macroscopic colony characterization and microscopic examination. Dermatophyte confirmation was undertaken by complementary tests such as hair penetration, corn meal agar medium containing 2% dextrose, and urea medium when it was necessary. Yeast identification was only based on colony characterization. Data analyzing was performed using SPSS version 13 for descriptive analyzing.

Results

Of 593 total collected samples, 323(54.47%) were positive for fungi agent. The most common fungal contaminations were as follows: 372(89.2%) saprophytic, 32(7.7%) yeast and 13(3.1%) dermatophyte species.

Dermatophytes were isolated 13 times as follows: below dressing rooms area 10 cases, margin of pool walls 2 cases, and foot washing sink one case. The isolated dermatophytes species were *Trichophyton mentagrophytes*, *T. rubrum*, *T. verrucosum* and *Epidermophyton floccosum* (Fig. 1). The fungi isolated from water of swimming pools included saprophytic filamentous and some of yeast species with predominant of *Aspergillus* and *Penicillium* (Fig. 2). According to our results, fungi species such as *Aspergillus*, *Mucor*, *Yeast* and *Penicillium* were in high frequency among isolated agents from environmental surfaces.

Mean pools water pH was 6.33-7.29, and average residual chlorine concentration was 1.76 (SD=0.85-2.75).

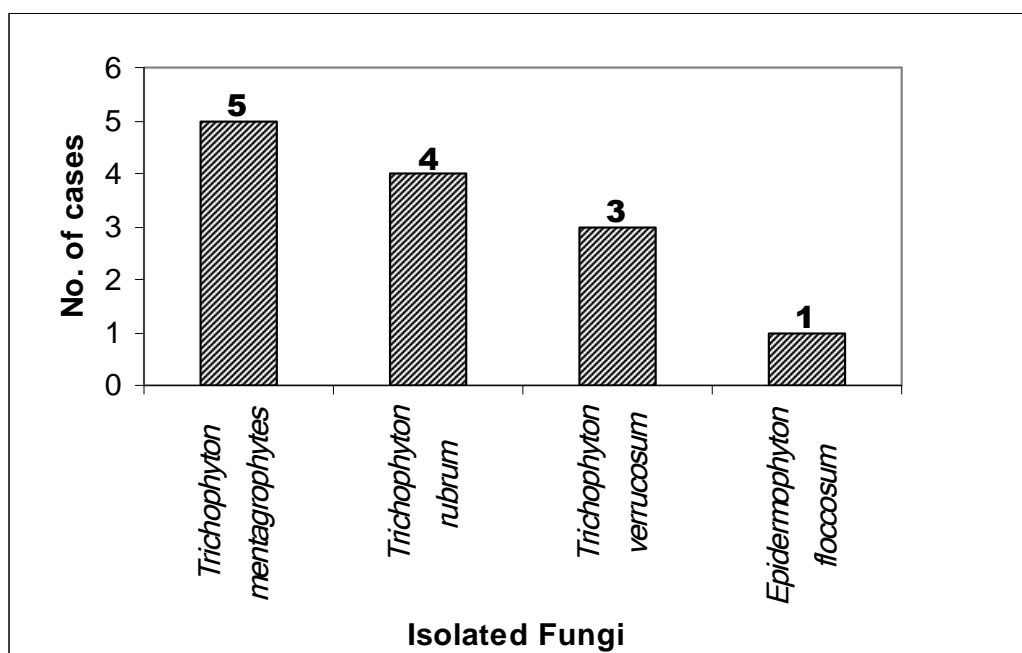


Fig. 1: Types of isolated dermatophytic fungi from environmental and foot washing sink of swimming pools

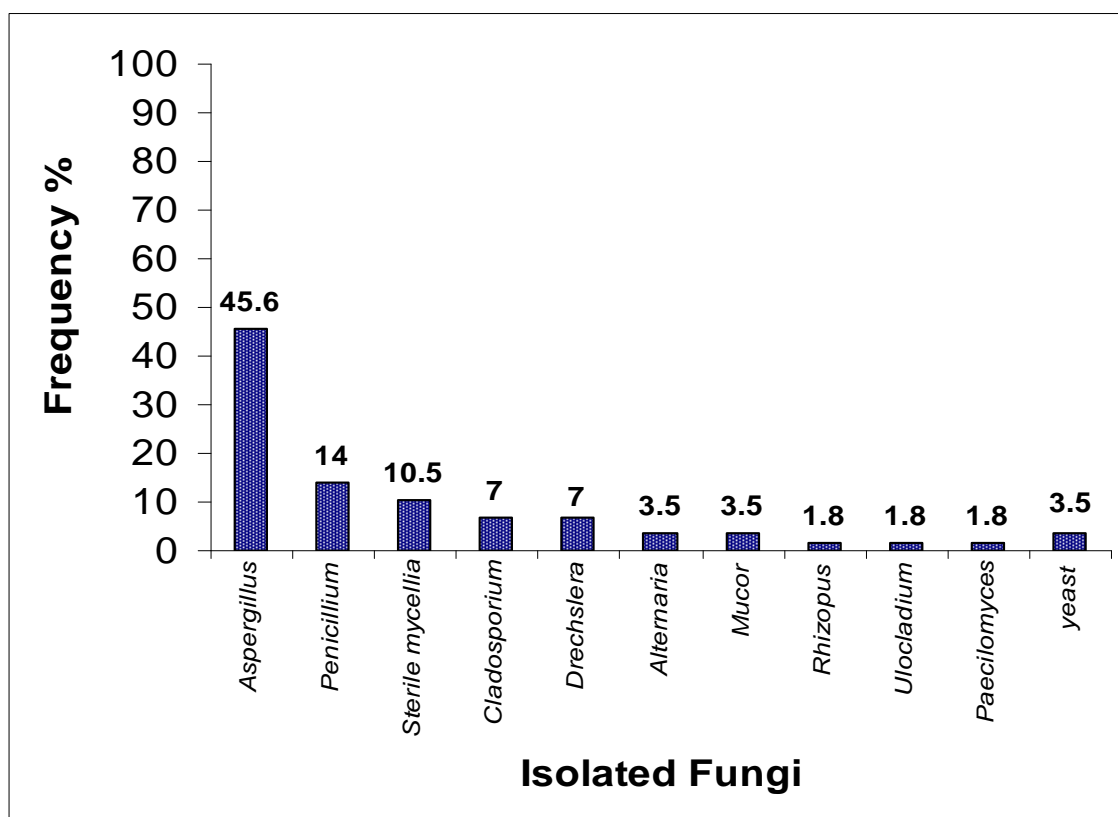


Fig. 2: Types of isolated saprophytic fungi from water of swimming pools

Discussion

Different studies indicated that swimming pools may play as a potential resources for spreading of pathogenic and/or potentially pathogenic fungi to human populations (1, 4-6). This is more important in tropical district especially during summer, because of more bather users.

Our result indicated that isolation of dermatophytes in 13 cases, which is one of the most important points of the present study. It is in agreement with some other studies (1-13). Most of these cases were isolated from floor of changing rooms. Isolation of dermatophytes agents from environmental area of swimming pools have been reported by previous investigators (1-7, 11-13). This part of public swimming pools has suitable environmental condition for fungal agents. Contamination of environmental pools, mainly comes from fungal particle shed from infected bathers, predominantly from tinea pedis cases who usually walk bare footed on the floor (1-5, 11, 12). Special attention should be regarded for hygienic condition of this area, as it is being used by all bath users and potentially is the most important of infection source. The current study revealed isolation of *T. rubrum* from foot washer sink which is enriched with chloride residue, as antimicrobial agent. We were not been able to find any similar report in literature review. Isolation of *T. rubrum* from high concentration chloride may be an indication of dermatophytes resistance, or species biodiversity that needs more details consideration.

Trichophyton mentagrophytes and *T. rubrum* were the most common dermatophytes isolated, from floor of changing rooms. These dermatophytes are the most causative agents of tinea pedis (9). As mentioned previously bathers were spreading fungal spore while walking on the floor, which is in agreement with other authors, to prevent these infections, regional health policy makers should advised swimming pools managers to clean frequently and carefully, especially floors and environment of changing area (8,16-20).

The present study indicated that saprophytic and/or pathogenic fungi were isolated from %54.47 of water or environmental samples. Bath users are in water and environment contact and even water may be swallowed accidentally, therefore sanitary quality of indoor public swimming pools is one of the critical point to prevent any possible fungi infection.

The present study indicated the existence of saprophytic agents i.e. *Aspergillus*, *Mucor* and *Rhizopus* in water and environmental pools which are in agreement even with recent researches (20, 21).

In view of isolation of saprophytic and pathogenic fungi from water and environmental sources of swimming pools, it can be concluded that more attention regarding hygienic disciplines on bath users and swimming pools regulation, i.e. effective cleaning before and after bath must be undertaken to prevent fungal diseases.

Ethical Consideration

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgments

We are grateful of Infectious and Tropical Diseases Research Center, East and West Health Centers and swimming pools staff for their collaboration and Mr. Mohammad Ali Gharri for sample collection. This work was supported by a grant from Ahwaz Jundishapour University of Medical Sciences. The authors declare that they have no conflicts of interest.

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