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Pathogenic Fungal Flora of The Turkish Hammams(Bath)

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Abstract

In Turkish society, hammams(baths) have an important place in social and cultural life as well as in cleaning up and health. Common facilities such as hammams, swimming baths and saunas are convenient for fungal contamination and colonization. However, according to our literature search, there is not enough study about Turkish baths. In Kahramanmaraş where the bath culture is very common, there are 12 hammam(public baths). From different parts of the bath and common materials, 368 specimens were taken to search for fungal pathogens. *Trichophyton rubrum*, *T. mentagrophytes*, *Epidermaphyton floccosum, Candida albicans, Alternaria sp.* and *Rhodotorula sp.* were isolated from the slippers and floor covering of the clothing rooms. Mostly *Aspergillus* sp. along wtih *Penicillium* sp., *Rhizopus* sp., and *Alternaria* sp. were isolated from the specimens taken from the floor, walls, windows and seats of the baths. No fungal isolations from the heating stones and loincloths, the hottest parts of the baths, were obtained. As a result of this study, it was concluded that especially the carpets of the clothing places (68.4%), floors (46.4%) and common slippers (44.7%) in Turkish hammams(baths) in Kahramanmaraş city center had fungal contamination and infection risk. This study demonstrate that Hammams existing a potential source of pathogenic fungi which may burden a real important on public health.

Keywords: Pathogenic fungi, hamam(bath), infection

Introduction

The number of people going to swimming pools, baths and hot springs for sports, better health and entertainment is increasing day by day. Traditional Turkish hammams and bathrooms have an important place in public health. In Turkish society and many other societies, baths have an important place in social and cultural life as well as in cleaning up and health. The people have been using the baths for centuries to clean up and heal some diseases. Baths, swimming pools and hot springs are humid environments that are open to common use. The most common fungal infection factors are places in public baths and swimming pools where people have a high potential of transfer and transmission. In such places, fungal infectious agents can easily be transmitted from common objects and floors(Goksugur et al. 2006; Rafiei, and Amirrajab, 2010).

Many researchers have made fungus isolation studies from swimming pools and baths(.Goksugur et al. 2006; Rafiei, & Amirrajab, 2010; Dindarloo, et al., 2005; Kazemi-fard et al, 2004; Seyedmousavi et al, 2007; Brandi et al, 2007; Maida et al, 2009;Benammar, et al. 2017;Tabatabaei et. al. 2020;Savcı & Şahin, 2019).

Located in Turkey's eastern Mediterranean region, Kahramanmaraş is a medium-sized city with a population of about 600,000. There are historical baths in Kahramanmaraş as well as Turkish baths which have been built in recent times. There are a total of 12 baths, 7 of which are historical Turkish baths and the 5 of them are non-historic baths. Of these, 3 of the historical Turkish baths and 3 of the non-historical ones were included in this study.

Kahramanmaraş, is one of the cities where historical and traditional bath culture has been well established. The aim of this study was to determine the fungal contamination rate of the baths used in Kahramanmaraş city center.

Materials and methods

Specimens were collected from walls of baths, heating stone, hammams windows, floors of hammams, slippers, floor covering of dressing place, wrapped clothes (peshtemals) and heating stone is a large marble stone, at the centre where the customers lie on. It acts as a central rubdown platform and is mentioned belly stone. (Goksugur

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et al. 2006).

There are 3 types of baths in terms of the customers; men's baths, women's baths and the interchangeable ones (scheduled to be used by men and women separately at the specified times). We collected the spacimens at the closing times or switching time before the cleaning was done.

Sample Collection

184 specimens from the historical baths(oldest than one hundred years) and another 184 specimens from the non-historical baths(newer than one hundred years) were collected. Specimens were collected from wet surfaces by rubbing with a sterile cotton swabs(a period of three months from Mar 2018 up to May 2018). Three of the bath included in the study are used by male and female alternatively, two female and only one male customers.To get the sample from dry surfaces, swabs were moistened with sterile isotonic saline solution. The surfaces was swabbed by moving with circular motions in a 10 cm^2 diameter circle. The swab was turn round in the course of sampling to ensure that the entire surface of the swab was used. A timbered spatula was used to scratch the floor covering and the peshtemal onto disposable petri dish. The erased material was inoculated in a manner similar to that of other specimens. Microscobic examination was not performed on samples taken from these places. Spacimens inoculated on to three type agar plates, Sabouraud dextrose agar (SDA) , corn meal agar, potato dextrose agar. Biochemical test with API 20C AUX system (Biomerieux, Marcy-l'Etoile France). All cultures were incubated at 30 C^o for at least 4 weeks, and were observed once every 3 days for fungal growth. All yeast cultures were identified using colony morphology, germ tube test, microscopic morphology on corn meal agar . Dermatophyte recognition was done according to microscopic and macroscopic evaluations of the positiv cultures and slide culture (Goksugur et al. 2006; Larone, 2002).

A total of 368 specimens were collected from hammam walls, tools and floors, and were screened for fungal pathogens. Of the 368 spcimens, 76 were collected from different places of floors, 26 from heating stone, 83 from walls of the hammams, 18 from windows, 38 from floor covering of the dressing places, 76 from slippers, 28 from peshtemals and 23 from bank.

Results

In terms of fungal pathogens, 67 spacimens (36.4%) obtained from the historical baths and 66 spacimens (35.8%) from the non-historical baths yielded growth. There was no statistically significant difference between the historical baths and bathroom-type hammams(p=0,8494, p>0.05, Z test).

After in culture growth and recognation, the following species were identified: of 83 spacimens from walls of the hammams(bath), 3 *Candida albicans*., 12 *Aspergillus sp*., 8 *Penicillium sp*., 1 *Alternaria sp*. and 1 *Trichophyton rubrum*; of 76 spacimens from floors of bath, 2 *Trichophyton rubrum*, 3 *Candida albicans*., 1 non *albicans*, 1 *Rhodotorula sp*, 17 *Aspergillus sp*. and 9 *Penicillium sp*.; of 38 spacimens from carpets of the dressing places, 4 *Trichophyton rubrum*, 2 *T. mentagrophytes*, 1 *Epidermaphyton floccosum*, 5 *Candida albicans*., 3 *Aspergillus sp*., 4 *Alternaria sp*., 2 *Rhodotorula sp*., 4 *Penicillium sp* and 2 *Rhizopus sp*.; of 76 spacimens from slippers, 13 *T. rubrum*, 3 *T. mentagrophytes*, 2 *Epidermaphyton floccosum*, 5 *Candida albicans* and 4 *Rhodotorula sp*.; of 18 spacimens from hammam indows, 3 *Aspergillus sp*. and 3 *Penicillium sp*.,. None of the samples taken from heating stone(central massage platforms) and wrapped clothes (peshtemal) showed fungal growth. The results of the isolations are summarised in Table I.

Discussion

Skin maceration and exposure to more pathogenic fungi have an important role in increasing the prevalence of surface fungal infections. Common facilities such as hammams(baths), swimming pools and saunas are suitable for fungal contamination and colonization.Also. Many studies have indicated that the hygen level of public swimming pools is a concern for swimmers due to swallowing and contact with water. In addition to important factors such as moisture and temperature, paying attention to hygiene and cleaning agents are also key components in the development and growth of fungi. As a result of massage, pathogenic fungi and infected tissue pieces are scattered into the ground. When the principles of hygiene are not observed pr conductedoperly, infected tissue fragments, pathogenic fungi and other contaminants are thought to increase fungi and hence increase the infection through being a source of nutrition for the fungi. In various studies, regular cleaning of the surroundings of the swimming baths has been shown to decrease the rate of tinea pedis(Kamihama et al, 1997; Watanabe et al, 2000; , Nanbaksh et al, 2004).

In some studies, fungal infection risks were investigated in baths and saunas(Goksugur et al.

2006; Matos et al, 2002, Laraqui et al, 2000; Savcı & Şahin, 2019). Based on our literature search, in a study conducted by the Göksügür et al. and Savcı and Şahin in Turkey. Pathogenic fungi were isolated from the bath walls (12.5% of the samples), window edges (25%), the floor covering of the dressing places, and slippers (14.2%). No fungi were isolated from the bath grounds, the heating stones and the loincloths; *Aspergillus sp*.(25%), *Penicillium sp*.(25%), *Epiderma floccosum*(6.2), *T. rubrum*(18.7%) and *Candida sp*.(18.7) by Göksügür et al. In a study conducted by Savcı and Şahin they determined the rate of *Aspergillus sp*. (51.3%), *Trichosporon sp*. (15.4%), *Candida sp*. (5.2%) and *Trichophyton tonsurans* (5.1%)(Goksugur et al. 2006; Savcı & Şahin, 2019).

In this study, *Aspergillus sp.* (31.2%), *Penicillium sp.*(19.8%), *Trichophyton rubrum* (15.2%), *T. mentagrophytes* (3.8%), *Rhodotorula sp*.(%5.3) and *Candida sp* (12.2%) were determined.

Laraqui et al, have isolated 100% pathogenic fungi on the bath floors in Marrakech. In a study on "fungal contamination of the interior of traditional baths" by Benammar et al., the highest rate of contamination was obtained from the spacimens taken from the floors of the doors and massage platforms(Laraqui et al, 2000; Benammar et al, 2017).

In this study, pathogenice and opportunistic pathogenic fungi were isolated the most from the floor covering of dressing places (68.4%), bath marble floors (46%), slippers (42.1%), window edges (33.3%), seating benches (21.7%) and bath walls (30.1%). The pathogen fungi were not isolated in the spacimens taken from the loincloths and heating stones. This might be due to washing of loincloths with detergent and high temperature water, and the effect of high temperature on the heating stone may cause dermatophyte and other infectious fungi to die.

The rate (35.5%) of pathogenic and opportunistic pathogenic fungi isolated in this study, is not as high as the rate (100%) of pathogenic fungi isolated from spacimens taken from the floor of Moorish baths that are similar to Turkish baths; but it is higher than the rate (7.6%) obtained in previous studies on Turkish baths(Goksugur et al. 2006; Nanbaksh et al, 2004).

In the entrance areas of the baths, there are common areas for dressing and resting places. Common items, common places (especially floor covering carpets of clothing places and resting rooms) and slippers can be an important factor in the transmission and spread of pathogenic fungi, especially when they are not sufficiently and regularly treated with cleaning agents. One of the important results obtained in this study was the isolation of pathogenic fungi with the highest rate (68.4%) from the spacimens taken from the floor covering carpets on these floors. Another important result is dermatophytes (which are the causative agents of tinea pedis and dermatophytosis) to constitute an important part (42.1%) of the fungi isolated from the common slippers while the remaining part is constituted by airborne fungi such as *Aspergillus* sp. and *Penicillium* sp. The rate (46%) of pathogenic and airborne fungi obtained from bath grounds is also thought to be an important finding. The high rate of dermatomycosis in the region means that the customers of the baths can have a high rate of infection. This situation is thought to be a factor that increases the contamination and infection in the baths(Tanis et al, 2010).

Conclusion

As a result, the Turkish hammams(baths) in the center of Kahramanmaraş are thought to have a significant risk of fungal contamination and infection, especially in the floor covering carpets and common slippers used in dressing places. Measures such as regular use of more effective cleaning agents and treating of common slippers with chlorinated water and cleaning agents or use of disposable slippers should be taken to ensure that bath customers are not infected. The more detailed researchs are clearly needed to better understand and search other related factors that influence pathogen fungal contamination in hammams and to suggest measures against fungal spreading in such indoor environment which imposing a important threat on public health and enviroment health.

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*Table I.***Distribution of fungi in different parts and tools of hammams**

	Walls of baths	Marble floor of baths	vicinity of Windows	Carpets of dressing rooms	Slippers	Pestemal	Banks	Göbek taşi	Total	Percentage
Sample taken	83	76	18	38	76	28	23	26	368	
Total positive sample	%30.1(25)	%46(35)	%33(6)	%68(28)		%42.1(32)	-	-	131	%35.5
Trichophyton rubrum	1	2	-	4	13	-	-	-	20	%15.2
T. mentagrophytes	-	-	-	2	3	-	-	-	5	%3.8
Epidermophyton floccosum	-	-	-	1	2	-	-	-	3	%2.2
Total dermatophyte mold	1	2	-	7	18	-	-		28	%21.2
Aspergillus sp	12	17	3	3	5	-	3	-	41	%31.2
Penicillium sp.	8	9	3	4	-	-	2	-	26	%19.8
Alternaria sp	1	-	-	4	-	-	-	-	6	%4.5
Rhizopus sp	-	2	-	2	-	-	-	-	5	%3.8
Total non dermatophyte mold	21	28	6	13	5	-	5		78	%59.3
Rhodotorula sp.	-	1	-	2	4	-	-	-	7	%5.3
Candida albicans	3	3	-	5	5	-	-	-	16	%12.2
Non albicans	-	1	-	1	-	-	-	-	2	%1.5
Total yeast	3	5	-	8	9	-	-		25	%19