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INDOOR AIR STUDY OF FUNGI CONTAMINATION AT INTERNAL DEPARTMENTS FOR STUDENTS IN THI-QAR GOVERNORATE

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ABSTRACT

Purpose: The purpose of the study was evaluation of the fungal presence in the environment of an internal departments for students. **Materials and methods:** The environment testing was carried out at a internal departments for students May 2014. The materials to mycological examinations were air samples (10 bedrooms) and swabs from two locations the kitchen (wall, floor, sink, cook, refrigerator, R.O-tank) and the bathroom (wall, floor, lavatory, washing machine). Samples were collected weekly. The findings were processed statistically. The t-test and Least significance difference to compared between the means were used. The border value of significance was 0.05. **Results:** The following fungal pathogens isolated from indoor environment of females internal department were *Asperegillus flavus, A.niger, Candida albicans, Candida* spp., *Rhodotorula* spp. and *Trichosporon* spp. In contrast, colonies isolated from indoor environment of males internal department were *Candida albicans, Candida* spp., *Asperegillus niger, Aspergillus* spp. and *Trichosporon* spp. In both departments *Candida* spp. were most frequently isolated from the indoor environment. A significant increase in the fungi isolated from the air and walls between departments was found. **Conclusions:** The main fungal pathogens isolated from the air samples were *Candida* spp. and *Aspergillus* spp. in the internal departments for students. Fungal occurrence in the air of rooms and walls varied between the both departments.

KEYWORDS: *Candida* spp, internal departments for Students, Fungi Contamination.

INTRODUCTION

Molds are found almost everywhere in our environment, both outdoors and indoors,but most of our life is spent indoors. Therefore, indoor air pollution may present a greater risk to human health than exposure to atmospheric air contaminants (Lis, 2001). One kind of indoor air pollutant is airborne microorganisms – bacteria and fungi (Jones,1999). Fungi are particularly dangerous because they show a substantial tolerance to environmental conditions. In addition, they require lower relative humidity (RH) than bacteria for their development and produce spores that are easily dispersed by moving air. Dispersion of spores is the main cause of contamination in the environment (Voletin,2007) .Fungal contamination in indoor environments has been shown to produce allergenic and toxigenic effects in occupants of the buildings (Miller,1990 ; Murrry, *et al.*,1988 ; Kurup,1989 ; Block,1989).Inhalation of fungal spores, fragments (parts), or metabolites (e.g., mycotoxins and volatile organic compounds) from a wide variety of fungi may lead to or exacerbate immunologic (allergic) reactions, cause toxic effects, or cause infections(Leventin,1995 ;Husman,1996 ; Burge& Otten,1999). All moulds have the potential to cause health effects such as headaches, breathing difficulties, skin irritation, allergic reaction and aggravation of asthma symptoms (Mold Remediation in Schools and Commercial buildings,2001). Moulds readily enter indoor environments by circulating through doorways, windows, ventilation systems, and air conditioning systems. Spores in the air also deposit on people and animals, bags, and pets common carriers of mold into indoor environments (Rolka *et al.*, 2005). The quality of air and the number of pathogens depend on the condition and cleanliness of the building, appropriate humidity and temperature and good ventilation, access to light, oxygen and water (Apter *et al.*,1994 ; Bachmann & Myers ,1995 ; Bartzokas,1975 ; Verhoeff *et al.*,1994). The pathogenic process depends on the quality and the condition of the building as well as on the time of exposure to fungi spores present in the air (Bush ,1989 ;Hoppe ,1995).

To our knowledge no study on environment contamination by fungi in the internal departments for students in Thi-Qar governorate was performed .The aim of this study was to assess the presence of airborne fungi

and fungal flora in two internal departments for students in Thi-Qar governorate.

MATERIALS AND METHODS

Background: Because fungi in the indoor environment strongly affect not only damage to and the deterioration of building materials, but also affect human health, it is important to know the distribution of fungi within an indoor environment. Therefore, in the present study, we examined fungi in the environment of two internal department for students in Thi-Qar governorate.

Samples collection

Investigations were carried out at two internal department, one for females students (loacted in the Thaora region) and another for males students (loacted in the Haboby region).

Swabs were taken from two locations the kitchen (wall, floor, sink, cook, refrigerator, R.O-tank) and the bathroom (wall, floor, lavatory, washing machine). Air samples were taken from 10 rooms, The culture medium was positioned in the middle of the room,0.5m above the floor, the windows and doors of the room were closed during the sampling period. Samples were collected weekly.

Culture of samples

All samples cultured on Petri dish with sabouraud dextrose agar medium with chloramphenicol were added to prevent bacterial growth. The fungi were identified from macroscopic and microscopic characteristics on the basis of their appearance in the culture as well as their morphological features in direct preparations stained with lactophenol (de Hoog *et al.*, 2000). The yeast-like fungi were Gram-stained and cultured on SDA media and biochemical tests were appropriate. For each positive sample, fungal contamination was estimated by counting frequency percentage for samples and occurrence percentage for isolates using a formula:

$$\text{Frequency percentage} = \frac{\text{No. colony for genus or type}}{\text{Total colony number for all fung}} \times 100$$

$$\text{Occurrence percentage} = \frac{\text{No. isolates for genus or type}}{\text{Total isolate number for all fungi}} \times 100$$

The findings were processed statistically. The t-test and Least significance difference to compared between the means were used. The border value of significance was 0.05.

RESULTS

Table 1: Fungi colonies isolated from the air in rooms tested of the females internal department .The following fungal pathogens isolated from air were: *Asperegillus flavus, A.niger, Candida* spp.

Table 1: Fungi colonies isolated from the air in rooms tested of the females internal department

Site of sambling	Number of colony	Taxonomy
Room 1	5	*Aspergillus flavus*
Room 2	5	*Candida* spp.
Room 3	1 56	*A.niger* *Candida* spp.
Room4	2	*Candida* spp.
Room5	0	No growth
Room6	6	*Candida* spp.
Room 7	9	*Candida* spp.
Room 8	1	*A.niger*
Room9	2	*A.niger*
Room10	5 2	*Candida* spp. *A.niger*
9.4±4.44		

Table 2: Fungi colonies isolated from the air in rooms tested of the males internal department .The following fungal pathogens isolated from air were: *Candida albicans, Candida* spp. and *Asperegillus niger*.

Table 2: Fungi colonies isolated from the air in rooms tested of the males internal department

Site of sambling	Number of colony	Taxonomy
Room 1	1 12	*Candida albicans* *Candida* spp.
Room 2	1	*A.niger*
Room 3	4	*Candida* spp.
Room4	1	*A.niger*
Room5	1 13	*Candida albicans* *Candida* spp.
Room6	1	*A.niger*

Room 7	0	No growth
Room 8	7	*Candida* spp.
Room9	0	No growth
Room10	0	No growth
	4.1±3.14	

The Frequency percentages for air fungi in the internal department of the females were as follows: *Candida* spp.(88.29%), *Aspergillus niger*(6.38%) and *A.flavus*(5.31%). While, the Frequency percentages for air fungi in the internal department of the males were as follows *Candida albicans* (4.87%),*Candida* spp. (87.80%) and *A.niger*(7.31%). In both departments *Candida* spp. were most frequently isolated from the air (figure 1).

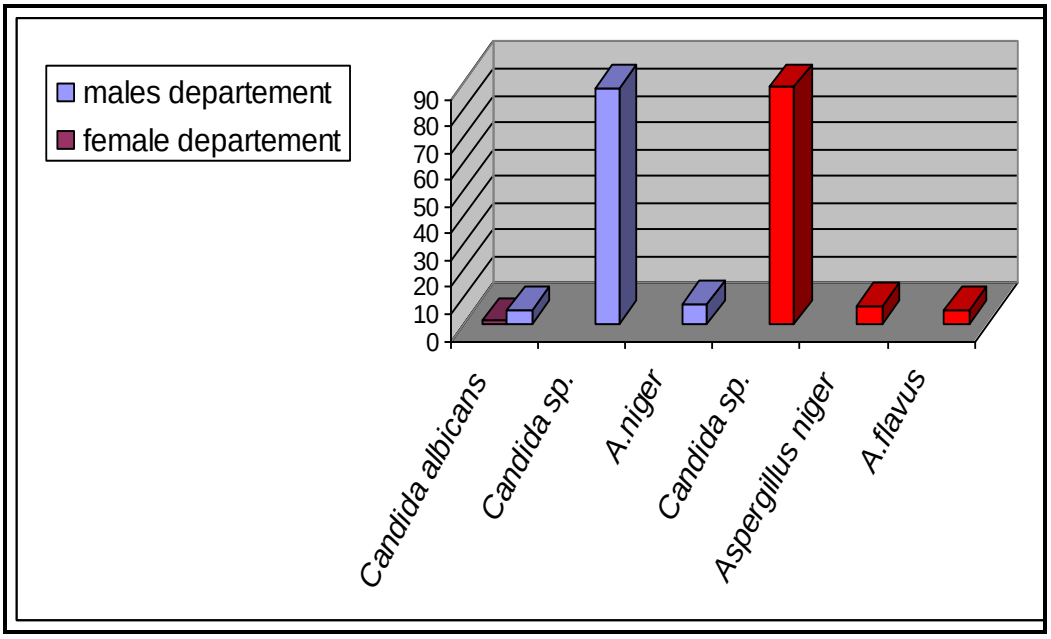

Figure 1: Frequency percentages for air fungi in females and males departments

Table 3: Numbers of fungi isolated from kitchen and bathrooms of the females internal department .The following fungal pathogens isolated from kitchen were : *Candida* spp.,*Rhodotorula* spp. and *Trichosporon* spp. In contrast, *Candida albicans*,*Candida* spp. ,*Rhodotorula* spp. and *A.niger* isolated from bathrooms .Significant (P<0.05) defferences between kitchen and bathrooms in the isolation of fungal colonies from the walls in the females internal department were found.

Table 3: Numbers of fungi isolated from kitchen and bathrooms of the females internal department

kitchen		**Bathroom**	
Site of sampling	Taxonomy	Site of sampling	Taxonomy
Wall	*1Candida* spp. *1Trichosporon* spp.	Wall	*1Candida* spp.
Foor	*1Candida* spp. *1Rhodotorula* spp.	Floor	*1Candida* spp. *1Rhodotorula* spp.
Sink	No growth	Lavatory	*2Candida albicans* *1A.niger*
Cook	*1Candida* spp.	Washing machine	No growth
Refrigerator	*1Candida* spp.		
R.O -tank	***1Candida* spp.**		

Table 4: Numbers of fungi isolated from kitchen and bathrooms of the males internal department. The following fungal pathogens isolated from kitchen were: C*andida albicans, Candida* spp.,*Aspergillus* spp. and *Trichosporon* spp. In contrast, *Candida albicans* ,*Candida* spp. and *A.niger* isolated from bathrooms. Significant (P<0.05) defferences between kitchen and bathrooms in the isolation of fungal colonies from the walls in the males internal department were found.

Table 4: Numbers of fungi isolated from kitchen and bathrooms of the males internal department

kitchen		**Bathroom**	
Site of sampling	Taxonomy	Site of sampling	Taxonomy
Wall	*1Candida* spp. *1Aspergillus* spp.	Wall	*1Candida* spp.
Floor	*1Candida albicans* *1Trichosporon* spp.	Floor	*2Candida albicans*
Sink	No growth	Lavatory	*3Candida albicans* *1A.niger*
Cook	*2Candida* spp.	Washing machine	*1Candida* spp.
Refrigerator	*1Candida* spp. *1A.flavus*		
R.O -tank	**No growth**		

Occurrence percentages for swab fungi in the females internal department were detected in the bathrooms : *Candida albicans(*28.57%),*Candida* spp. (28.57%), *A.niger*(14.28%), *Rhodotorula* spp.(14.28%) and *Trichosporon* spp.(14.28%).while, in the kitchen :*Candida* spp.(62.5%) ,*Rhodotorula* spp.(12.5%) and *Trichosporon* spp. (12.5%) (figure 2).

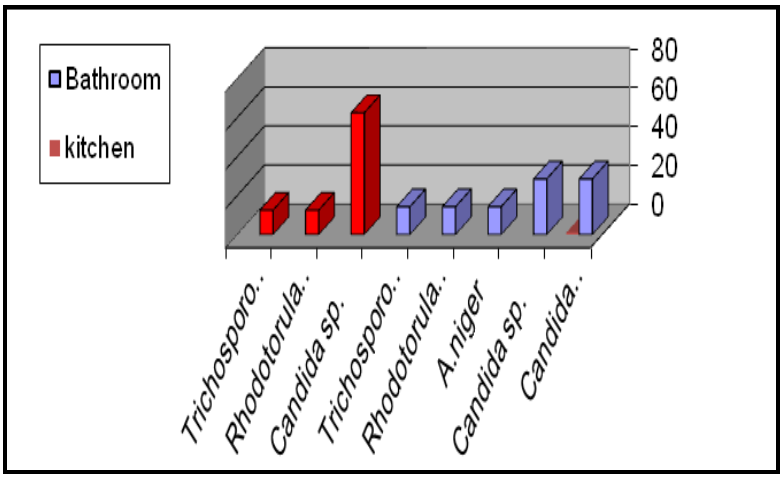

Figure 2: Occurrence percentages for swab fungi in the females internal department

In contrast, in the males internal department Occurrence percentages for swab fungi were detected in the bathrooms : *Candida albicans(*100%),*Candida* spp. (28.57%) and *A.niger*(14.28%). while, in the kitchen : *Candida albicans(*20%), *Candida* spp.(40%), *Aspergillus* spp.(20%) and *A.flavus* (20%) and *Trichosporon* spp.(20%) (figure 3).

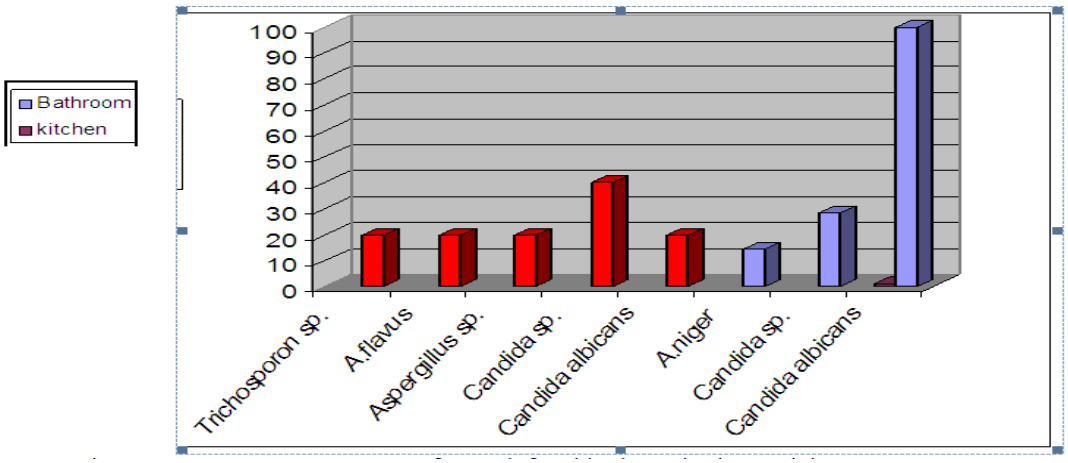

Figure 3: Occurrence percentages for swab fungi in the males internal department

Significant difference ($p<0.05$) in mean number of fungi colonies between the departments was found.

DISCUSSION

In the present study, we demonstrated considerable numbers of fungi in the air of the two internal departments for students in Thi-Qar governorate. This is the first study carried out for assess the fungal contamination of indoor air in this departments. We performed the study in May.

The dominant colonies isolated from indoor environment of females internal department were *Asperegillus flavus, A.niger, Candida albicans, Candida* spp.,*Rhodotorula* spp. and *Trichosporon* spp. In contrast, colonies isolated from indoor environment of males internal department were *Candida albicans, Candida* spp., *Asperegillus niger, Aspergillus* spp. and *Trichosporon* spp.

In our study we found a high occurrence of *Candida* species and *Aspergillus* species in the indoor air in the both tested departments, the highest numbers of airborne fungi spores were recorded during summer (Krajewska-Kulak *et al.*, 2009). *Candida* species are yeasts that are widely distributed in the environment and are members of the normal microbial flora of the human body, Infection with the yeast *Candida* is the most frequent cause of fungal disease, they may somehow cause infection to unaware members. *Aspergillus* species are molds found in organic matter transmissible via inhalation **(**Alwakeel, 2007), large amounts of *Aspergillus* were found in the indoor air because that fungal genus is abiquitous (Gniadek and Macaura, 2007). It can cause a broad spectrum of disease in humans, ranging from hypersensitivity reactions to direct angioinvasion **(**Alwakeel, 2007). *Aspergillus niger* has also been implicated to cause heavy environmental contamination in the a kitchen (London *et al.* 1996). Fungi in these and other genera affect humans in complex ways and are capable of causing avariety of diseases, such as infection, allergy and irritation, and toxicosis (Krajewska-Kullak *et al*.,2009).

The presence of many biological agents in indoor environments is attributable to dampness and inadequate ventilation. Excess moisture on almost all indoor materials leads to growth of microbes, such as mould, fungi and bacteria, which subsequently emit spores, cells, fragments and volatile organic compounds into indoor air (NYCDHM,2008).

Indoor moisture can result from numerous causes, such as: facade and roof leaks; plumbing leaks; floods; condensation; and high relative humidity (NYCDHM,2008).

Surface contamination with settled fungal spores, which is not detected by air sampling, could also present a source of potential colonization (Hay *et al*.,1995). Fungal conidia enter buildings through windows, doors or ventilation systems and sediment onto surfaces, survive in dust or grow on organic matter present in materials such as ceiling tiles (Arnow *et al.,* 1991; Vonberge & Gastmerier,2006).

CONCLUSIONS

According to the results shown we could say that the main fungal pathogens isolated from the air samples were *Candida* and *Aspergillus*. Fungal occurrence in the air of rooms and walls varied between the both departments. The opportunistic fungi can be inhaled in the department by students and exacerbate asthmatic attacks and pneumonia. Further investigations on isolation of the fungal pathogenes from the air samples of these departments are needed.

Recommendations

- Cleaning should be done using a soap or detergent solution. Use the gentlest cleaning method that effectively removes the mold to limit dust generation.
-The underlying moisture problem must be corrected to prevent recurring mold growth. Relative humidity should be kept low enough to prevent condensation on windows and other surfaces.
- All buildings should be checked routinely for water leaks, problem seals around doors and windows, and visible mold in moist or damp parts of the building.
- Any conditions that could be causes of mold growth should be corrected to prevent future mold problems.

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