
Incidence of *Aspergillus* species in Hospital Environment

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Abstract:

The aim of this study was to determine the prevalence of *Aspergillus* species among the Hospital environment in Southwestern, Libya. A total of 549 microbiological environmental samples were included in this study for prevalence of *Aspergillus* species. 448 (81.6%) of these sample have shown fungal growth.

During this study, 2607 fungal colonies were identified, 2010 (77.1%) of these were molds species. The most common isolated molds were *Aspergillus* species 1878 (72%). The highest percentage of isolated *Aspergillus* species were *A. niger* 1241 (66.1%), followed by *A. fumigatus* 281 (15%), *A. terreus* 156 (8.3%), *A. flavus* 128 (6.8%), *A. glaucus* 40 (2.1%), *A. nidulans* 31 (1.6%) and *A. clavatus* 1 (0.1%).

The distribution of *Aspergillus* species among the Hospitals environment was the highest in Pediatric ward, Female ward, Radiology unit, Corridors, ICU and Dialysis unit, respectively.

Key words: *Aspergillus*, Hospital environment, Libya.

Introduction:

Aspergillus species are saprophytic, thermos tolerant fungi that are ubiquitous in the air [1]. *Aspergillus* spores are commonly found in air, water, soil, plant debris, rotten vegetation, manure, sawdust litter, animal feed, on animals and indoor air environment [2, 3].

Similarly, *Aspergilli* can be present in Hospital environments in unfiltered air, ventilation systems, contaminated dust, water, food, and ornamental plants [4-6].

The various species of *Aspergillus* produce large numbers of small conidia that become airborne and can be inhaled easily; they then colonize the upper or lower respiratory system [7, 8].

These conidia often remain in the air for prolonged periods due to their small size [9]. However, under special circumstances, *Aspergillus* species can produce a spectrum of diseases include mycotoxicosis, allergy, and invasive infections. Invasive infections depend on the interplay between host susceptibility and environmental exposure to

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the conidia. There is limited invasion by *Aspergilli* in immunocompetent individuals [10]. Airborne *Aspergillus* species have been linked closely with exacerbation of asthma and other allergic respiratory diseases [11].

More than 250 species of *Aspergillus* have been described. These are organized into subgenera and sections, or species complexes, based on morphological, metabolic, and molecular characteristics [7, 9], and about 20 can cause human infections. *Aspergillus fumigatus* is most common species found in human infections all over the world [1].

Invasive aspergillosis remains a major cause of morbidity and mortality in immunosuppressed patients with profound granulocytopenia secondary to haematological malignancies, or solid organ and bone marrow transplantation [8, 9]. Outbreaks of aspergillosis in patients admitted to intensive care units (ICUs) have been reported [6, 12].

Aspergillus spp. can also cause pneumonia in ICU patients without classical predisposing factors, as well as community-acquired pneumonia in otherwise immunocompetent healthy individuals [13, 14]. Aspergillosis is opportunistic respiratory infection which causes about 40% of fatal nosocomial infections [15].

The aim of this study was to evaluate the prevalence and distribution of *Aspergillus* species among Hospitals environment in Southwestern, Libya.

Materials and Methods:

Between July 2013 to March 2014, a total number of 549 microbiological environmental samples were collected from two main Hospitals (Sebha Medical Center and Brak General Hospital) Southwestern, Libya.

Environmental sampling was carried out looking for fungi in the Hospitals indoor environment. Random duplicated, surface samples from different sites were collected by

cotton swabs from subjected Hospitals such as patient room, clinics, machines, windows, corridors, air-conditions, floors and furniture. Each dust sample directly cultured in Sabouraud Dextrose Agar (SDA) plate (Oxoid, UK) or immediately transported within 2-4 hours to the laboratory for culturing under septic conditions.

Cultured plates are incubated at 25° C with daily observation of the plates for fungal growth for 5-7 days. Pure cultures were made from all morphologically different colonies. One plate was incubated at 37° C, and the second was incubated at 25° C. Macroscopic and microscopic examination used to observe growth and nature of their growth. The fungal colonies were identified to genus (subgenus in the case of *Aspergillus* isolates) according to the available mycological keys manuals and textbooks. The tests were based mainly on growth colonial morphology, reverse and surface coloration.

Results and Discussion:

Airborne fungi and their products can cause a variety effects in human health such as infections, hypersensitivity pneumonitis and toxic reactions [5, 16]. The indoor environment is highly suitable for fungal development [17]. In hospital facilities the quality of indoor air is very important factor to preventing hospital-acquired infections [18].

During the study period, a total of 549 sample were collected from the subjected Hospitals, 448 (81.6%) of these sample have fungal growth and the other sample 101 (18.4%) are showed completely no growth after one week of incubation. 2607 fungal colonies were identified during the study 2010 (77.1%) of these were molds species and 597 (22.9) were yeasts species. Based on our results, the major part of isolated fungi was molds, many mold types can be survive in different environments and produce spores in large number, they

transmitted by the air and isolated easily from hospital environment [9].

Sixteen mold species were isolated and identified from all studied Hospital units during the study period (Table 1), the most common isolated molds were *Aspergillus* species 1878 (72%) followed by other molds species in different percentages. *Aspergillus* and *Penicillium* spores were found in all environments, due to the large number and to the ability to survive in the air for long time [7].

These results are similar to that recorded by many other studies in different area of the world [5, 6, 16]. While Azimi et al (2013) found *Penicillium* spp. are the highest species isolated from the air of hospital rooms in Tehran, Iran followed by *Aspergillus* spp. [19].

Yeast species are the second most isolated fungi 584 (22.4%). The yeast percentage in this study were high than this isolated by Altayyar et al (2012) from Sebha Medical Centre in Libya [5] and by Saadoun et al (2008) in Jordan [6], A total of 44 (1.7%) unknown filamentous fungi growth were isolated and considered unknown molds.

Out of 1878 colonies of *Aspergillus* species, a total of 7 species were obtained from all studied samples. *A.niger* is the most common *Aspergillus* species were isolated during this study, followed by *A.fumigatus*, *A. terreus* and *A.flavus* with 66.1%, 15%, 8.3% and 6.8%, respectively. While other *Aspergillus* species *A. glaucus*, *A.nidulans* and *A. clavatus* were isolated in low percentages (Table 2).

Table 1: Total number and percentage of isolated fungi from all studied units

Isolated Fungi	Total Number	Total Percentage (%)
<i>Aspergillus</i>	1878	72
Yeast	584	22.4
Unknown mold	44	1.7
<i>Rhizopus</i>	28	1.1
<i>Curvularia</i>	16	0.6
<i>Altrnaria</i>	14	0.6
<i>Graphium</i>	10	0.5
<i>Penicillium</i>	8	0.3
<i>Mucor</i>	6	0.2
<i>Chaetomium</i>	3	0.1
<i>Phialophara</i>	3	0.1
<i>Biploras</i>	3	0.1
<i>Nigrospora</i>	2	0.06
<i>Basdiolus</i>	2	0.06
<i>Epicocum</i>	2	0.06
<i>Chrysosporium</i>	2	0.06
<i>Verticillium</i>	1	0.03
<i>Absdi</i>	1	0.03

Table 2: Total number and percentage of isolated *Aspergillus* species.

<i>Aspergillus</i> species	Total Number	Total Percentage (%)
<i>A.niger</i>	1241	66.1
<i>A.fumigatus</i>	281	15
<i>A. terreus</i>	156	8.3
<i>A.flavus</i>	128	6.8
<i>A. glaucus</i>	40	2.1
<i>A.nidulans</i>	31	1.6
<i>A. clavatus</i>	1	0.1

Table 3: Distribution of isolated *Aspergillus* species in Hospital environment.

Hospital Words	Range	Mean
Pediatric word	0-39	6.1
Female word	0-27	5.28
Corridors	1-25	5.2
Dialysis unit	0-19	4.4
Radiology unit	0-27	4.1
ICU	1-20	4
Emergency Department	0-5	3.6
Male Word	1-8	3.3
Labor room	1-8	3.2
Respirotory Clinic	0-17	2.6
Laboratory	1-6	2.1
Reception	0-7	2
ENT & OPTH Clinic	1-7	1.9
Dermatology Clinic	0-4	1.47
Operation theater	0-2	0.8

Aspergillus SPP. especially *A.niger*, *A. fumigates*, *A. flavus* and *A. terreus* are frequently isolated and grow in the Hospitals environment. This *Aspergillus* species were considered the major source of fungal infections in Hospital and can cause nosocomial infections [6, 20]. *A.niger* was the highest isolated mold in the environment of Sebha Medical Centre, Libya [5]. While *A. fumigates* was major species of *Aspergillus* were isolated in other study [21], this may be related to outdoor contamination, Hospital unit and the type of patient infection.

Table 3 showed the distribution of *Aspergillus* species among the Hospitals environment with variable levels. Fungal contamination is an important risks factor for patients and staff in these rooms [22]. In this study, the highest range and mean of contamination by *Aspergillus* species is appear in Pediatric word, Female word, Radiology unit, Corridors, ICU and Dialysis unit, respectively. The building design, outdoor contamination and human activities can recognize as the main factors of Hospital contamination.

Azimi et al (2013) found, the highest percentage of fungal contamination appear in Orthopedics Operating Room and in Nursing Stations [19], while in our study the highest percentage of fungal contamination appear in Pediatric ward, Pediatric ward, Corridors, Dialysis unit, Radiology unit and Intensive

Care Unit, respectively. Similar to our results Perdelli et al (2006) recorded that *Aspergillus* species were isolated in low percentage from operating theaters and predominant in working and open area of hospital such as wards, kitchen, outpatient departments and laboratories [22].

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