

# Indoor Fungal and Bacterial Contaminations on Household Environment in Riyadh, Saudi Arabia

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## Abstract

This study was conducted to determine the microbial and inhabitant of household environment in Riyadh, Saudi Arabia. Overall, a total of 180 samples were collected and analyzed for fungal growth, 160 house samples were obtained on BAP medium and PDA medium. The Eastern Riyadh region turned out with the highest fungal isolates with 15/61 (24.6%). Among the most common fungal isolates from bedroom carpets were *Aspergillus niger* (21.6%), *Alternaria sp.* (15.7%), *Aspergillus flavus* (15.7%) *Candida sp.* (11.8%), *Cladosporium sp.* (9.8%) and *Rhizopus sp.* (9.8%). Other fungal isolates from bedroom carpets included *Penicillium sp.* (5.9%), *Cunninghamella sp.* (3.9%), *Rhodotorula sp.* (3.9%) and *Aspergillus terreus* (1.9%) Overall relative densities from all specimens obtained from household carpets, bedroom walls and carpet stores showed *Alternaria sp.* as the most common fungal isolate (55.3%) followed by *Aspergillus niger* (29%), *Aspergillus flavus* (19.3%), *Rhizopus sp.* (9.7%) and *Penicillium sp.* (7.0%). Other fungal isolates such as *Candida spp.*, *Cladosporium spp.*, *Cunninghamella spp.*, *Rhodotorula sp.* and *Aspergillus terreus* had less than 6% overall relative density. From 40 carpet specimens collected for microbial analysis, 20 (50%) showed bacterial growth. *Bacillus spp.* was the most common isolated organism (35%) followed by *Staphylococcus epidermidis* (10%), *Epiococcus spp.* (10%), *Corynebacterium spp.* (10%) and *Bacillus polymyxa* (10%). Other bacterial isolates included *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Bacteroides spp.*, *Clostridium spp.* and *Staphylococcus aureus*. The presence of these fungal and microbial pathogens poses risk for individuals. When possible, floor carpeting in homes should be minimized or avoided since this serves as habitats for opportunistic fungi and infectious agents that pose harm to one's health.

**Key words:** fungi, bacteria, carpets, Saudi Arabia.

## Introduction

Many homes in Saudi Arabia favor carpeting over vinyl flooring. Carpeting improves aesthetics, reduces noise, and helps prevent slips and falls. But the possible spread of infectious diseases and odors caused by microorganisms, and the treat of allergies resulting from inhibited growth of microorganisms is a concern. (Jaakkola *et al.*, 2006).

In the home, odors caused by microorganisms may be troublesome in carpets. These organisms cause odors, defacement, and deterioration of carpets. Many of these microorganisms are associated with allergic reactions and potentially infectious diseases (Anderson 1969, 1982).

Biological evaluation of carpets indicated that microbial counts increased over time reaching a plateau about 4 weeks with slight reduction by vacuuming. Predominating bacteria was *Staphylococcus epidermidis*. Other organisms included *Staphylococcus aureus*, *Enterobacter* and *Escherichia* groups. (Hicks *et al.*, 2005) A later study was conducted in hospital carpets and found that recovery rates for *Enterobacter*

*spp.*, *Klebsiella pneumoniae* and *Escherichia coli* were higher from carpet than from bare floor. (Hicks *et al.* 2005). A study conducted in Saudi Arabia on prosthetic and surface-covering materials found *Pseudomonas aeruginosa*, *Escherichia coli* and *Staphylococcus aureus* contaminated floor carpets. Carpets had significantly higher bacterial count than many other floor covering materials. (Bahannan and Abdel-Salam 2002). Recently, a study with 127 asthmatic patients and 127 controls, compared and evaluated the environmental conditions in the homes of these patients, found *Aspergillus* and *Penicillium*, the most common isolated species. Furthermore, homes with floor carpeting had higher mould counts than those with wooden parquet flooring. (Ceylan *et al.*, 2006).

This study was conducted to determine the bacterial and fungal isolates from indoor carpets and bedroom walls in several homes in Riyadh, Saudi Arabia. Furthermore, we also aimed to determine the effect of temperature changes on fungi isolated from these homes.

## Materials and Methods

The study was conducted from April to May 2007 at the start of the summer season in Saudi Arabia, when most people prefer to stay indoors due to hot and dry weather conditions. Specimens were collected from 5 houses – 4 samples from every household – from different places in Riyadh City (northern district, southern district, eastern district and western district). Each sampling from each house of different was done in duplicate. A total of 160 house samples were obtained. Overall, a total of 180 samples were collected and analyzed for fungal growth.

### Sample collection and isolation from bedroom walls

Four swabs were used to obtain samples from bedroom walls of 5 houses from all 4 districts in Riyadh. Two swabs were streaked across Blood Agar Plate (BAP) for isolation and identification of bacteria, and the other two swabs to Potato Dextrose Agar (PDA) for fungi. A total of 80 samples were collected from bedroom walls (Rolka *et al.*, 2005).

### Sample collection and isolation from bedroom carpets

BAP and PDA plates were used to collect samples from bedroom carpets from 5 randomly selected houses from all 4 districts in Riyadh City. Plates were placed inverted over the carpet for at least one minute for sampling. Two replicas of each sample were done from each plate. A total of 40 BAP and 40 PDA samples were collected from bedroom carpets (Wistreich *et al.*, 1984).

All samples were bought with their security seals unopened and ensured were in their required storage temperatures. Samples were taken to the microbiology laboratories of Girls College of Education in Riyadh, Saudi Arabia for analysis.

### Physiological test to determine the effect of temperature on fungal growth

Three replicas of PDA were inoculated with every species of fungi that has been isolated. Fungal isolates were inoculated to discs with a diameter of 1.5 cm. and were incubated at temperatures of 5°C, 10°C, 15°C, 25°C, 30°C, 45°C and 50°C for 14 days. After 14 days, the diameter of fungal growth on the discs was measured and the average level of growth was taken.

### Microbiological analysis

Under sterilized conditions, BAP and PDA were incubated at 30°C for 48 hours. After sufficient incubation requirements, microorganisms were identified using the API 20E system (Analytical Profile Index, Biomerieux, Durham, NC, USA). Fungal identification was done microscopically.

Relative densities of fungal growth were calculated based on the number of positive isolates divided by the total number of positive isolates x 100.

## Results

A total of 180 specimens were collected and analyzed for fungal and bacterial growth. Of 80 samples obtained from carpet specimens from different households in Riyadh, Saudi Arabia, 61 (76.3%) were positive for fungal growth. The Eastern Riyadh region turned out the highest fungal isolates with 15/61 (24.6%). The other regions of Riyadh City had 12/61 (19.7%) each positive isolates. Among the most common fungal isolates from bedroom carpets were *Aspergillus niger* (21.6%), *Alternaria spp.* (15.7%), *Aspergillus flavus* (15.7%) *Candida spp.* (11.8%), *Cladosporium spp.* (9.8%) and *Rhizopus spp.* (9.8%). Other fungal isolates from bedroom carpets included *Penicillium spp.*, *Cunninghamella spp.*, *Rhodotorula spp.* and *Aspergillus terreus*. (Table 1 and Table 3).

Of 80 specimens obtained from bedroom walls, 44

**Table 1.** Fungi isolated from carpet specimens in Riyadh city homes.

Region	No. of positive isolates	Identified fungal isolates
South Riyadh	12	<i>Aspergillus flavus</i> (3)
		<i>Alternaria spp.</i> (3)
		<i>Aspergillus niger</i> (2)
		<i>Cladosporium spp.</i> (2)
		<i>Aspergillus ferreus</i> (1)
		<i>Penicillium spp.</i> (1)
North Riyadh	12	<i>Aspergillus flavus</i> (3)
		<i>Alternaria spp.</i> (2)
		<i>Aspergillus niger</i> (3)
		<i>Cladosporium spp.</i> (1)
		<i>Rhodotorula spp.</i> (2)
		<i>Candida spp.</i> (1)
West Riyadh	12	<i>Aspergillus flavus</i> (1)
		<i>Alternaria spp.</i> (2)
		<i>Aspergillus niger</i> (2)
		<i>Cladosporium spp.</i> (1)
		<i>Penicillium spp.</i> (1)
		<i>Candida spp.</i> (2)
		<i>Rhizopus spp.</i> (2)
		<i>Cunninghamella spp.</i> (1)
East Riyadh	15	<i>Aspergillus flavus</i> (1)
		<i>Alternaria spp.</i> (1)
		<i>Aspergillus niger</i> (4)
		<i>Cladosporium spp.</i> (1)

**Table 1 cont.**

		<i>Penicillium</i> spp. (1)
		<i>Candida</i> spp. (3)
		<i>Rhizopus</i> spp. (3)
		<i>Cunninghamella</i> spp. (1)

**Table 2.** Fungi isolated from bedroom wall specimens in Riyadh city homes.

Region	No. of positive isolates	Identified fungal isolates
South Riyadh	9	<i>Alternaria</i> spp. (3)
		<i>Aspergillus niger</i> (4)
		<i>Penicillium</i> spp. (1)
		<i>Rhizopus</i> spp. (1)
North Riyadh	11	<i>Aspergillus flavus</i> (4)
		<i>Alternaria</i> spp. (2)
		<i>Aspergillus niger</i> (4)
		<i>Rhizopus</i> spp. (1)
West Riyadh	12	<i>Aspergillus flavus</i> (2)
		<i>Alternaria</i> spp. (3)
		<i>Aspergillus niger</i> (5)
		<i>Penicillium</i> spp. (1)
		<i>Rhizopus</i> spp. (1)
East Riyadh	12	<i>Aspergillus flavus</i> (2)
		<i>Alternaria</i> spp. (3)
		<i>Aspergillus niger</i> (4)
		<i>Rhizopus</i> spp. (3)

**Table 3.** Relative densities of positive fungal isolates from specimens collected at various sites in Riyadh city, Saudi Arabia.

Fungal isolates	Household carpets	Bedroom walls	Overall relative density
<i>Alternaria</i> spp.	8/51 (15.7)	11/44 (25.0)	55.3
<i>Aspergillus niger</i>	11/51 (21.6)	17/44 (38.6)	29.0
<i>Aspergillus flavus</i>	8/51 (15.7)	8/44 (18.2)	19.3
<i>Rhizopus</i> spp.	5/51 (9.8)	6/44 (13.6)	9.7
<i>Penicillium</i> spp.	3/51 (5.9)	2/44 (4.6)	7.0
<i>Candida</i> spp.	6/51 (11.8)	-	5.3
<i>Cladosporium</i> spp.	5/51 (9.8)	-	4.4
<i>Cunninghamella</i>	2/51 (3.9)	-	1.8
<i>Rhodotorula</i> spp.	2/51 (3.9)	-	1.8
<i>Aspergillus terreus</i>	1/51 (1.9)	-	0.9

Note: overall relative density = no. of positive isolates/total no. of isolates x 100 Values in parenthesis indicate percentage.

(55%) were positive for fungal isolates. The Eastern and Western Riyadh regions posted identical fungal isolated percentages of 27.3%, Northern Riyadh posted 25% positivity and Southern Riyadh with 20.5% positive

fungal isolates. Among the most common fungal isolates from bedroom walls, *Aspergillus niger* posted the highest frequency with 38.6% followed by *Alternaria* spp. (25%), *Aspergillus flavus* (18.2%), *Rhizopus* spp. (13.6%) and *Penicillium* spp. (4.6%). (Table 2 and Table 3).

Overall relative densities from all specimens obtained from household carpets and bedroom walls and carpet stores showed *Alternaria* spp. as the most common fungal isolate (55.3%) followed by *Aspergillus niger* (29%), *Aspergillus flavus* (19.3%), *Rhizopus* spp. (9.7%) and *Penicillium* spp. (7.0%). Other fungal isolates such as *Candida* spp., *Cladosporium* spp., *Cunninghamella* spp., *Rhodotorula* spp. and *Aspergillus terreus* had less than 6% overall relative density. (Table 3).

Of 40 carpet specimens collected for microbial analysis, 20 (50%) showed bacterial growth. *Bacillus* spp. was the most common isolated organism (35%) followed by *Staphylococcus epidermidis* (10%), *Epicoccus* spp. (10%), *Corynebacterium* spp. (10%) and *Bacillus polymyxa* (10%). Other bacterial isolates included *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Bacteroides* spp., *Clostridium* spp. and *Staphylococcus aureus*. (Table 4).

Physiological test to determine the effect of temperature on 4 test fungi (*Aspergillus niger*, *Aspergillus flavus*, *Rhizopus* spp. and *Alternaria* spp) showed peak fungal growth at 30°C. (Table 5 and Figure 1).

**Table 4.** Bacterial isolated from carpet specimens from domestic houses in Riyadh, Saudi Arabia.

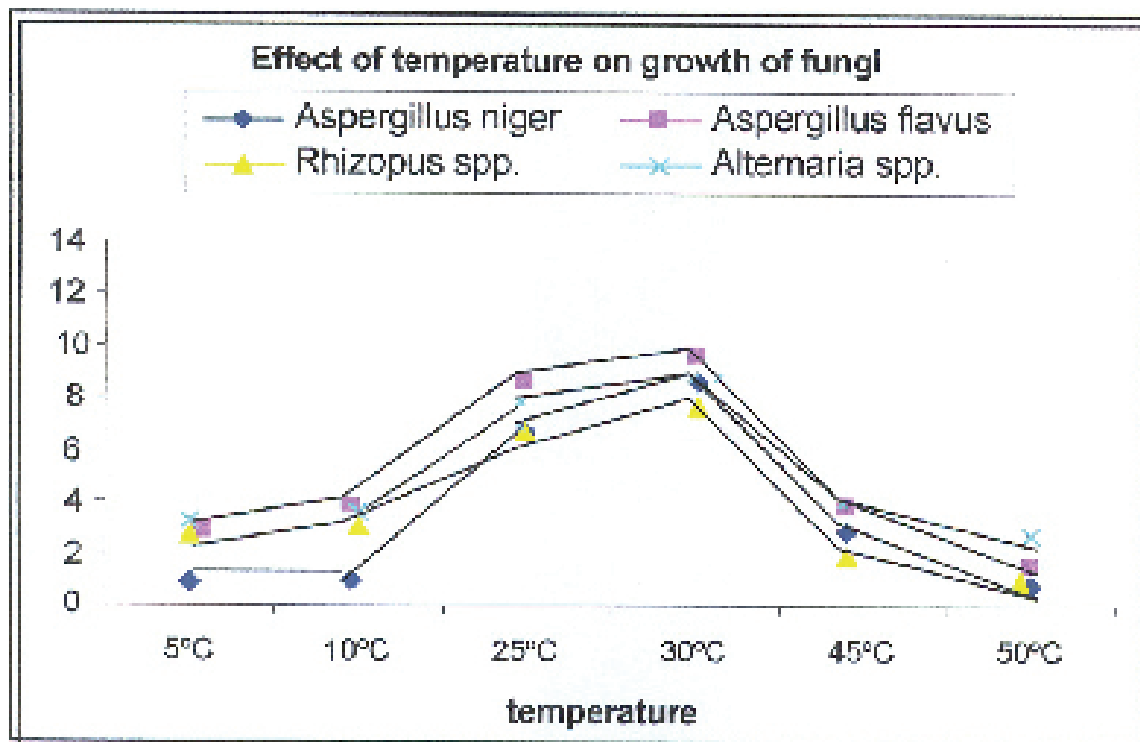
Region	No. of positive isolates	Microbial isolates
North Riyadh	5	<i>Staphylococcus epidermidis</i>
		<i>Bacillus</i> spp.
		<i>Corynebacterium</i> spp.
		<i>Bacillus polymyxa</i> (2)
South Riyadh	5	<i>Bacillus subtilis</i>
		<i>Pseudomonas aeruginosa</i>
		<i>Corynebacterium</i> spp.
		<i>Bacteroides</i> spp.
		<i>Epicoccus</i> spp.
West Riyadh	5	<i>Clostridium</i> spp.
		<i>Bacillus</i> spp. (2)
		<i>Staphylococcus aureus</i>
		<i>Epicoccus</i> spp.
East Riyadh	5	<i>Bacillus</i> spp. (4)
		<i>Staphylococcus epidermidis</i>

Note: values in parenthesis represent number of isolates.

**Table 5.** Effect of temperature on the growth of fungal isolates.

Fungal isolates	5 °C	10 °C	25 °C	30 °C	45 °C	50 °C
<i>Aspergillus niger</i>	2.3	2.6	6.4	8	3.4	2
<i>Aspergillus flavus</i>	2.3	2.7	8	8.6	3	1.9
<i>Rhizopus</i> spp.	2.1	2.2	6	8	2.4	1.5
<i>Alternaria</i> spp.	1.5	1.5	6.2	8.5	2.7	1.5

Note: Values are in milimeter.

**Fig 1.** Effect of temperature on the growth of fungi.

## Discussion

Our study showed the presence of different species of fungi namely, *Alternaria* spp., *Aspergillus niger*, *Aspergillus flavus*, *Rhizopus* spp., *Penicillium* spp., *Candida* spp., *Cladosporium* spp., *Cunninghamella* spp., *Rhodotorula* spp. and *Aspergillus terreus* insuring the results of pervious researches (Bakhali, Parvez 1999, Bokhary and Parves 1995).

*Alternaria* spp. is a potential allergic sensitizer in susceptible individuals and was thought to be a risk factor in sensitized individuals with symptoms of bronchial asthma and allergic rhinitis in Saudi Arabia. (Hasnain et al 1998). The spores of these fungi are known to be a major component in the outdoor environment with peaks in April and October, highest during summer. (Hasnain et al 1998)

(Cetinkaya et al. 2005).

*Aspergillus niger* is an agent of mold onychomycosis. (Hilmioglu-Polat 2005). It is also known to cause pulmonary intracavitary colonization, when associated with diabetes, the prognosis becomes generally poor due to acute oxalosis. (Severo et al 1997). *Aspergillus flavus* causes aspergilloma and chronic fibrosing pulmonary aspergillosis. (Pasqualotto and Denning 2007) (Hedyati et al 2007). It is also a major causative agent of endophthalmitis (Aydin et al 2007) and induces keratolytic malignant glaucoma (Jain et al 2007). Common clinical syndromes associated with *A. flavus* include chronic granulomatous sinusitis, keratitis, cutaneous aspergillosis, wound infections and osteomyelitis (Hedayati et al 2007).

*Rhizopus spp* causes zygomycosis, an increasingly emerging important infection with high mortality especially in immunocompromised patients. (Zaoutis *et al* 2007) *Penicillium spp.* have been variably implicated in causing disease in patients with chronic granulomatous disease, severe combined immunodeficiency, chronic mucocutaneous candidiasis and considered as an indicator disease of AIDS (Antachopoulos *et al* 2007), (Devi *et al* 2007) *Candida spp.* causes CNS infections either in the meninges or brain (Chakrabarti *et al* 2007) *Cladosporium spp.* present in animal coats causes phaeohyphomycosis. (Mariani *et al* 2002) *Cunninghamella spp.* causes pulmonary mucormycosis and the very rare lung mucormycosis and nosocomial invasive infection exclusively in immunocompromised patients (Lasalle *et al* 2007), (Passos *et al* 2006) *Rhodotorula spp.* can cause opportunistic mycoses in immunocompromised patients and meningitis in HIV infected patients (Pamidimukkala *et al* 2007). (Thakur *et al* 2007) *Aspergillus terreus*, a less common pathogen causes aspergillosis with severe neutropenia. (Tokimatsu *et al* 2007).

*Bacillus subtilis*, *Bacillus spp.* and *Bacillus polymyxa* has been used in animal feed, baking, cleaning and wastewater, food and beverage because of its capability to produce alpha amylase, crackerase and neutral protease that works at higher pH and temperature range that relaxes dough to get uniform crackers and improve cracker flavors (www.bio-cat.com). However, in the preparation of this enzyme needs inactivation of the sporulating capability of *B. subtilis* using high pressurized conditions (Vasanth *et al* 1983).

*Staphylococcus epidermidis* has become the most important cause of nosocomial infections in recent years. Its pathogenicity is mainly due to the ability to form biofilms on indwelling medical devices. In a biofilm, *S. epidermidis* is protected against attacks from the immune system and against antibiotic treatment, making *S. epidermidis* infections difficult to eradicate. (Vuong and Otto 2002) *Corynebacterium spp.* (coryneform) have been in the focus of attention in recent years since cases of osteomyelitis, cerebrospinal meningitis, endocarditis, bacteremia, urinary tract infections and liver abscess were associated with this agent. (Mickucka *et al* 1997) *Pseudomonas aeruginosa* has become an important cause of infection, especially in patients with compromised host defense mechanisms. It is the most common pathogen isolated from patients who have been hospitalized longer than 1 week. It is a frequent cause of nosocomial infections such as pneumonia, urinary tract infections (UTIs), and bacteremia. Pseudomonal infections are complicated and can be life threatening. (Qarah 2005) *Bacteroides* species are anaerobic bacteria

that are predominant components of the bacterial flora of mucous membranes and, therefore, are a common cause of endogenous infections. *Bacteroides* infections can occur in all body sites, including the CNS, the head, the neck, the chest, the abdomen, the pelvis, the skin, and the soft tissues. (Brook 2006). Pathogenic species of the genus *Clostridium* may contaminate the materials used in the injection of drugs and under the right conditions may cause serious or life-threatening disease. (Brazier *et al* 2002). *Staphylococcus aureus* is ubiquitous and may be a part of human flora, however, the organism may cause disease through invasion and toxin production such as abscess, pneumonia, diarrhea and the most feared toxic shock syndrome. (Tolan 2007).

The results of our study have several implications on the preference for floor carpeting. The presence of these fungal and bacterial pathogens poses risk for individuals. The result of the physiological effect of temperature on these fungi further showed that individuals are more at risk for opportunistic infection during summer months. This explains why most people experience a lot of respiratory symptoms from acute allergic rhinitis to pneumonia during climate changes especially during the summer months.

## Conclusion

When possible, floor carpeting in homes should be minimized or avoided since this serves as habitats for opportunistic fungi and infectious agents that poses harm to one's health.

## References

- Anderson R.L. 1969. Biological evaluation of carpeting. *Appl. Microbiology.*, 18 (2): 180-7.
- Anderson R.L., D.C. Mackel, B.S. Stoler and G.F. Mallison. 1982. Carpeting in hospitals: an epidemiological evaluation. *J. Clin. Microbiology.* 15 (3): 408-15.
- Antachopoulos C., T. J. Walsh and E. Roilides. 2007. Fungal infections in primary immunodeficiencies. *Eur. J. Pediatrics.* 166 (11): 1099-117.
- Aydin S., B. Ertugrul, B. Gultekin, G. Uyar and E. Kir. 2007. Treatment of two postoperative endophthalmitis cases due to *Aspergillus flavus* and *Scopulariopsis spp.* with local and systemic antifungal therapy. *BMC. Inf. Dis.* 31 (7): 87.
- Bahannan S.A. and M.M. Abdel-Salam. 2002. An in-vitro study of the effects of various disinfectants on prosthetic and surface materials. *Saudi. Med. J.* 23 (4): 396-9.
- Bahkali A.H., S. Parvez. 1999. Fungal flora min dust un Riyadh, Saudi Arabia. *Mycoses*, 42 (4): 339-430.
- Brazier J.S., B.J. Duerden, V. Hall, J.E. Salmon, J. Hood, M.M. Brett, J. McLauchlin and R.C. George. 2002. Isolation and identification of *Clostridium spp.* from infections associated

- with the injection of drugs: experiences of a microbiological investigation team. *J. Med. Micro.* 51: 985-9.
- Bokhary H. A. and S. Parvez. 1995. Fungi inhabiting household environments in Riyadh, Saudi Arabia. *J. Mycopathologia.* 130, ( 2), Springer Netherlands.
- Brook I. 2006. Bacteroides infections. <http://www.emedicine.com>.
- Cetinkaya Z., F. Fidan, M. Unlu, I. Hasenekoglu, L. Tetik and R. Demirel. 2005. Assessment of indoor air fungi in Western-Anatolia, Turkey. *Asian. Pac. J. Aller. Immu.* 23 (2-3): 87-92.
- Ceylan E., A. Ozkutuk, G. Ergor, M. Yucesoy, O. Itil, S. Caymaz and A. Cimrin. 2006. Fungi and indoor conditions in asthma patients. *J. Asthma.* 43 (10): 789-94.
- Chakrabarti A. 2007. Epidemiology of central nervous system mycoses. *Neur. India.* 55 (3):191-7.
- Devi K.R., L.R. Singh, R. Rajkumari, M. Usharani, Kh.S. Devi and T.B. Singh. 2007. Penicillium marneffeii – an indicator disease of AIDS: a case report. *Indian. J. Patho. and Micro* 50 (3): 674-6.
- Hasnain S.M., A. Al-Frayh, M.O. Gad-El-Rab and S. Al-Sedairy. 1998. Airborne Alternaria spores: potential allergic sensitizers in Saudi Arabia. *Ann. Saudi. Med.* 18 (6): 497-501.
- Hedayati M.T., A.C. Pasqualotto, P.A. Warn, P. Bowyer and D.W. Denning. 2007. Aspergillus flavus: human pathogen, allergen and mycotoxin producer. *Microbiology* 153 (Pt 6):1677-92.
- Hicks J.B., E.T. Lu, R. De Guzman, and M. Weingart. 2005. Fungal types and concentration settled dust in normal residences. *J. Occup. Environ. Hyg.* 2 (10): 481-92.
- Hilmioğlu-Polat S., D.Y. Metin, R. Inci, T. Dereli, I. Kiline and E. Tumbay. 2005. Non-dermatophytic molds as agents of onychomycosis in Izmir, Turkey—a prospective study. *Mycopathologia* 160 (2):125-8.
- Jaakkola J.J., A. Leromnimon and M.S. Jaakkola. 2006. Interior surface material and asthma in adults: a population-based incident case-control study. *Am. J. Epidemiol.* 15:164 (8): 742-9.
- Jain V., A. Maiti, D. Shome, N. Borse and S. Natarajan. 2007. Aspergillus-induced malignant glaucoma. *Cornea* 26 (6):762-3.
- Lasalle S., C. Butori, V. Hofman, M. Gari-Toussaint, J. Mouroux and P. Hofman. 2007. Pneumonia caused by Cunninghamella bertholletiae in a patient with acute lymphoblastic leukemia. *Ann. Pathol.* 27 (2):141-4.
- Mariani C.L., S.R. Platt, T.J. Scase, E.W. Howerth, C.L. Chrisman and R.M. Clemmons. 2002. Cerebral phaeohyphomycosis caused by Cladosporium spp. in two domestic shorthair cats. *J. Am. Animal. Hosp. Assoc.* 38 (3): 225-30.
- Micucka A., E. Gospodarek and M. Bialek. 1997. Opportunistic infections with coryneform. *Med. Sci. Monitor.* 3 (2):154-7.
- Pamidumukkala U., S. Challa, V. Lakshmi, A. Tandon, S. Kulkarni and S.Y. Raju. 2007. Sepsis and meningoencephalitis due to Rhodotorula glutinis in a patient with systemic lupus erythematosus, diagnosed at autopsy. *Neuro India.* 55 (3): 304-307.
- Pasqualotto. A.C. and D.W. Denning. 2007. An aspergilloma caused by Aspergillus flavus. *Med. Mycology.* 18:1-4.
- Passos X.S., W.S. Sales, P.J. Maciel, C.R. Costa, D.M. Ferreira and M.R. do Silva. 2006. Nosocomial invasive infection caused by Cunninghamella bertholletiae: case report. *Mycopathologia.* 161 (1): 33-5.
- Qarah S. 2005. Pseudomonas aeruginosa infections. [www.emedicine.com](http://www.emedicine.com).
- Rolka H, Krajewska-Kulak, Leszyska K, Oksiejczuk E, Jakoniuk P, Leszczynska K Niiczyprouk W, Penar-zadarko B. 2005. Indoor air studies of fungi contamination pf social welfare home in Czerwki in north- east Part of Poland Annales Academiae. *Medicae Bialastocensis* Vol. 50 Supp: 1.
- Severo L.C., G.R. Geyer, S. Nda Porto, M.B. Wagner and A.T. Londero. 1997. Pulmonary Aspergillus niger intracavitary colonization. Report of 23 cases and a review of the literature. *Rev. Iberoam. Micol.* 14 (3):104-10.
- Thakur K., G. Singh, S. Agarwal and L. Rani. 2007. Meningitis caused by Rhodotorula rubra in a human immunodeficiency virus infected patient. *Indian. J. Micro.* 25 (2): 166-8.
- Tokimatsu I., H. Kushima, A. Iwata, K. Hashinaga, K. Umeki, M. Ohama, K. Kohno, H. Ishii, K. Kishi, M. Ogata, K. Hiramatsu, T. Saikawa and J. Kadota. 2007. Invasive pulmonary aspergillosis with hematological malignancy caused by Aspergillus terreus and in vitro susceptibility of A. terreus isolate to micafungin. *Intern. Med.* 46 (11):775-9.
- Tolan R.W. Jr. 2007. Staphylococcus aureus infection. [www.emedicine.com](http://www.emedicine.com).
- Vasantha N., B. Uratani, R.F. Ramaley F and E. Freese. 1983. Isolation of a developmental gene of Bacillus subtilis and its expression in Escherichia coli. *Proc. Natl. Acad. Sci. USA* 80 (3):785-9.
- Vuong, C. and M. Otto. 2002. Staphylococcus epidermidis infections. *Microbes. Infect.* 4 (4): 481-9.
- Wistreich G.A., Max D. Lechtman. MACMILLAN 1984. Laboratory exercises in microbiology.
- Zaoutis T.E., E. Roilides, C.C. Chiou, W.L. Buchanan, T.A. Knudsen, T.A. Sarkisova, R.L. Schaufele, M. Sein, T. Sein, P.A. Prasad, J.H. Chu and T.J. Walsh. 2007. Zygomycosis in children: a systematic review and analysis of reported cases. *Pediatric. Inf. Dis. J.* 26 (8):723-7.

## التلوث البكتيري والفطري لبعض محتويات المنزل الداخلية في مدينة الرياض في المملكة العربية السعودية

سعاد صالح الوكيل

كلية التربية , قسم النبات , جامعة الرياض للبنات

### الملخص

هذه الدراسة أجريت لتحديد مدى التلوث الميكروبي في بيئة المنزل الداخلية في مدينة الرياض في المملكة العربية السعودية , تم تحليل ١٨٠ عينة من ١٦٠ منزل ممثلة للجهات الأربع في مدينة الرياض لكل من البساط الأرضي وجدران غرف النوم لتحديد العزلات الفطرية والبكتيرية المتواجدة عليها بعد زراعتها على أطباق بيئة ديكستروز البطاطس لعزل الفطريات وإطباق أجار الدم لعزل البكتيريا وأسفرت النتائج عن إن منطقة شرق الرياض سجلت أعلى نسبة في عدد عزلات الفطريات (٢٤,٦ %) و كان فطر *Aspergillus niger* أعلى نسبة بواقع (21.6%) يليه فطر *Alternaria sp.* (15.7%) ثم فطر *Aspergillus flavus* بواقع (15.7%) ثم كلا من الفطريات التالية على التوالي *Candida spp.* (11.8%), *Cladosporium sp.* (9.8%) *Rhizopus sp* وأيضاً تواجدت الفطريات التالية بنسبة اقل *Penicillium sp* (5.9%), *Cunninghamella sp.* (3.9%), *Rhodotorula* (1.9%) and *Aspergillus terreus* (3.9%) . وكذلك أسفرت النتائج عن كثافة تتواجد فطر *Alternaria spp* (55.3%) بنسبة عالية في كل من عينات البساط الأرضي والجدر يليها على التوالي *Aspergillus niger* (29%) , *Aspergillus flavus* (19.3%), *Rhizopus spp.* (9.7%) and *Penicillium spp.* (7.0%) ومن ٤٠ عينة بساط ارضي تم تحليل تواجدها البكتيريا بها شكلت البكتيريا العصوية أكثر الأجناس شائعة التواجد بواقع *Bacillus spp* (35%) , ثم تواجدها الأنواع البكتيرية الأخرى بنسبة اقل على التوالي كما يلي *Staphylococcus epidermidis* (10%), *Epiococcus spp.* (10%), *Corynebacterium spp.* (10%) and *Bacillus polymyxa* (10%). Other bacterial isolates included *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Bacteroides spp.*, *Clostridium spp.* and *Staphylococcus aureus* . إن تواجدها الفطريات والبكتيريا في البيئة المنزلية الداخلية قد يعرض الفرد لمخاطر صحية ولخطر العدوى بهذه الميكروبات ولا بد من التقليل من المكونات المنزلية التي تهيب البيئة المناسبة لنموها.