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ANALYSIS OF MICROBIAL QUALITY OF AIR IN KARACHI UNIVERSITY CAMPUS, KARACHI

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ABSTRACT

Air provide a medium for the growth of microorganisms, fungi and bacteria both, determine the environment health. We isolated different type of bacterial & fungal species at 4 different places indoor & outdoor environment. Most dominant species of fungus found in air belonged to the genera *Aspergillus, Scedosporum,* and *Mucor*. The dominant bacterial flora were composed of the genera *Bacillus*, *Staphylococcus* and *Micrococcus*. The microbial density was higher significantly in the outdoor air than the indoor air.

KEY WORDS: Microbial density, Non-fastidious bacteria, Incubation period.

INTRODUCTION

Atmosphere of earth constituents, many of the gases like nitrogen, oxygen, etc., (Zimmer and Carl, 2013). Different types of microorganisms survive in the atmospheric environment like bacteria, viruses, fungi, algae, protozoa which are harmful for the human health & also for the environment (Daisey *et al*., 2003). Air is mainly transporting medium for microorganisms, they pass off in low numbers in air when compared with soil or water. The micro flora of air can be studied outdoor and indoor as many types of microorganisms found in both environments, outdoor and indoor (Abdel and Farag, 1999; Dharmage *et al*., 1999). Microorganisms found in water may also be released into the air in the form of water droplets. Generally microbes enter into the atmosphere from natural and anthropogenic sources (Lighthart, 1997; Jones and Harrison, 2004; Hameed and Khoder, 2001) but the main sources of airborne microorganisms are human beings due todifferent activities like cough, sneeze, talk and laugh. Microbes in the air enter into the human body through food, water and cause harmful disease (Gorbushina and Palinska, 1999). The purpose of this work was to study the microbial quality of air and isolate microorganisms at different places public canteen, garden and microbiology laboratory. We isolated bacteria and fungal.

MATERIALS AND METHOD

Two types of media were used in this experiment SDA (Sabouraud Dextrose Agar) for fungal growth (Sandven and Lassen, 1999; Guinea *et al*., 2005) and nutrient agar for bacterial growth (Lapage *et al*., 1970). The purpose of using different media is this that fungal growth occurs at low pH while bacteria require high pH.

Nutrient agar: Nutrient agar is used for bacterial growth in this experiment that contain following ingredients like peptone, yeast, meat extract, sodium chloride & agar. It is all purpose media used for the cultivation of a wide variety of microorganisms. Nutrient agar is a microbiological growth medium commonly used for the routine cultivation of non-fastidious bacteria. pH adjusted to neutral (6.8) at 25°C (Lapage *et al*., 1970).

SDA (sabouraud dextrose agar): SDA is a selective media use for selective type of organisms & used for fungal isolation in this experiment. Sabouraud agar is a type of agar containing peptones. It is used to cultivate *dermatophytes* and other types of fungi (Sandven and Lassen, 1999; Guinea *et al*., 2005).

This experiment was performed in Institute of Environmental Studies, University of Karachi, Pakistan to isolate bacterial and fungal species from public canteen, garden and microbiology laboratory. We prepared Nutrient agar (20g for 1 liter) and SDA (65g for 1 liter) that is distributed into Petri plates. Each plate of SDA & Nutrient Agar was exposed to air at different places canteen, garden, microbiology laboratory left side & microbiology laboratory right side. The plates were exposed for 20 minutes and after that they were closed and incubated. The incubation period of both media is different that is 24hrs for Nutrient agar and 5 days for SDA. After the incubation different types of colonies developed were noted for their number of colonies, shape, size and texture to identify the organisms. Different type of staining techniques were employed to identify the organisms.

Simple staining: Only primary dyes were used. Organisms which retained the color of the primary dye were gram positive.

Method: Culture was taken on a slide. It was stained with Methylene blue for 1minute, crystal violet for 30 seconds and carbon fuchsine for 20 seconds.

Gram staining: Primary and secondary dyes were used. Organisms which retain the color of secondary dyes were gram negative.

Method: Culture was taken on a slide. Crystal violet was used for 1 minute, then iodine for 1 minute, alcohol for 15 seconds and sefranin in the last for 1 minute.

Capsule staining: Culture was taken on slide. Only crystal violet dye was used for 7 minutes and dried through the air not by heat.

Fungal staining: In this technique fungal colony was taken through a piece of tape. Then attached the tape to glass slide and then observed the slide on a microscope. In some method iodine & glycerin was also used for better results.

RESULTS AND DISCUSSION

Indoor study of microorganism presented below in Tables 1, 2, 3 and 4 showed a high growth of *Bacillus* and *Staphylococcus* species in nutrient agar while the dense growth of *Aspergillus niger* was observed in SDA.

Outdoor area: In outdoor observations on nutrient agar Staphylococcus and *Bacillus* species were observed at peak level, whereas *Fusarium* and *Aspergillus flavus* found a high growth on SDA indicated below in Tables 5, 6, 7 and 8.

Table 1. Growth of microorganisms and their characteristics on nutrient agar from microbiology lab (left side).

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	22	1-3	Yellow	Irregular	Smooth	Yes	*Micrococcus luteus*
2.	13	11	Translucent	Round	Rough	No	*Bacillus subtilis*
3.	65	1-5	White	Round	Rough	Yes	*Bacillus* sp.

Table 2. Growth of microorganisms and their characteristics on SDA from microbiology lab (left side).

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	4	27	White	Irregular	Rough	Yes	*Scedosporium aurantiacum*
2.	3	18	Orange	Irregular	Rough	No	*Alternaria alternata*
3.	1	15	Yellow	Irregular	Rough	No	*Microsporum* sp.
4.	2	25	Light brown	Irregular	Rough	No	*Ulocladium* sp.
5.	8	12	Black	Irregular	Rough	No	*Aspergillus niger*
6.	1	14	Pink	Irregular	Rough	Yes	*Fusarium* sp.

Table 3. Growth of microorganisms and their characteristics on nutrient agar from microbiology lab (right side).

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1	2	5	White	Irregular	Rough	Yes	*Bacillus* sp.
2	30	2	Cream	Round	Smooth	No	*Staphylococcus* sp.
3	15	5	Transparent	Irregular	Rough	Yes	*Bacillus subtilis*
4	20	1	Yellow	Round	Smooth	Slight	*Micrococcus luteus*
5	13	1	Transparent	Round	Smooth	Slight	*Bacillus subtilis*

Table 4. Growth of microorganisms and their characteristics on SDA from microbiology lab (right side).

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	3	15	Light pink	Rounded	Rough	Yes	*Fusarium* sp.
2.	5	4-25	White	Rounded	Rough	Yes	*Scedosporium aurantiacum*
3.	3	2	Orange	Rounded	Rough	No	*Alternaria alternata*
4.	10	8-10	Blackish (dark green)	Elliptical	Rough	No	*Aspergillus niger*
5.	2	5-15	White filaments	Rounded	Rough	Yes	*Mucor* sp.
6.	1	0.4	Cream	Rounded	Smooth	Yes	*Candida albicans*

Table 5. Growth of microorganisms and their characteristics on nutrient agar from canteen.

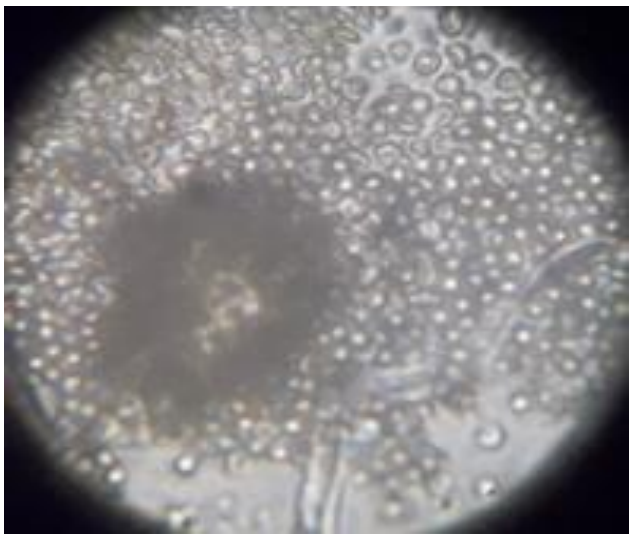
S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	64	1-6	White	Irregular	Smooth	No	*Bacillus subtilis*
2.	22	4	Cream	Round	Smooth	No	*Staphylococcus* sp.
3.	66	1-2	Golden	Round	Smooth	Yes	*Staphylococcus aureus*
4.	108	Pinpointed	Yellow	Round	Smooth	Yes	*Micrococcus luteus*
5.	158	Pinpointed	Cream	Round	Smooth	Yes	*Staphylococcus* sp.

Table 6. Growth of microorganisms and their characteristics on SDA from canteen.

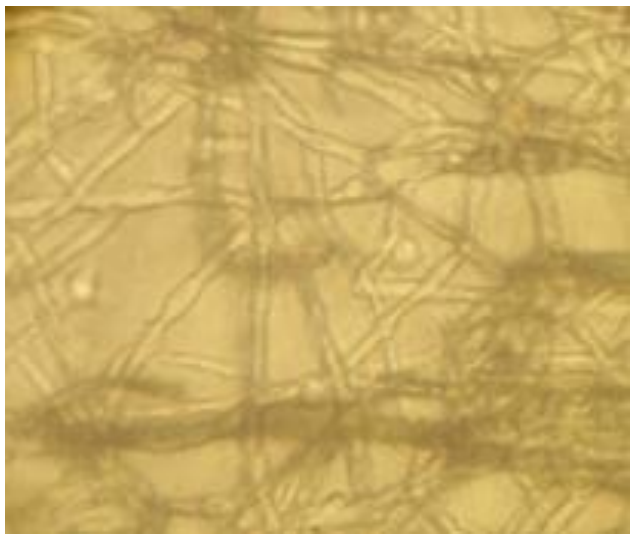
S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	18	5	Light green	Round	Rough	Yes	*Aspergillus flavus*
2.	42	8	Light pink	Irregular	Rough	Yes	*Fusarium* sp.
3.	25	1-4	Black	Round	Rough	Yes	*Aspergillus niger*
4.	25	8-10	White	Round	Rough	Yes	*Scedosporium aurantiacum*
5.	18	4	Yellow	Irregular	Rough	Yes	*Microsporum* sp.

Table 7. Growth of microorganisms and their characteristics on nutrient agar from garden.

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	43	2	Yellow	Rounded	Smooth	Yes	*Micrococcus luteus*
2.	186	1.5	White	Rounded	Smooth	Yes	*Bacillus* sp.
3.	21	6	Translucent	Irregular	Smooth	No	*Bacillus subtilis*
4.	100	1-3	Golden	Rounded	Smooth	Slight	*Staphylococcus aureus*

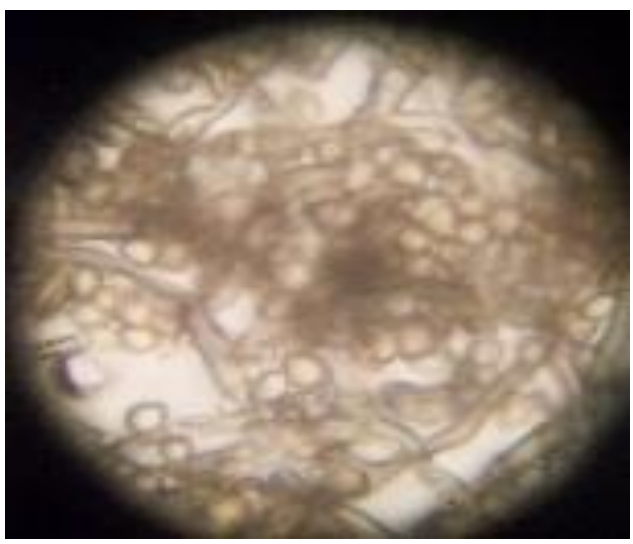


Aspergillus niger

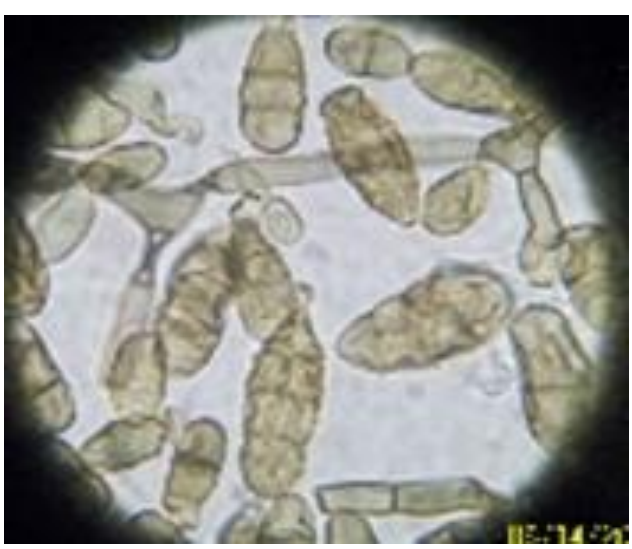


Candida albicans

Alternaria alternata



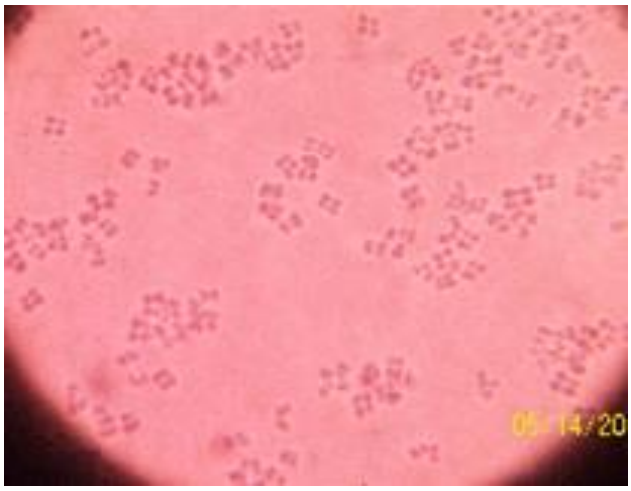
Scedosporium aurantiacum



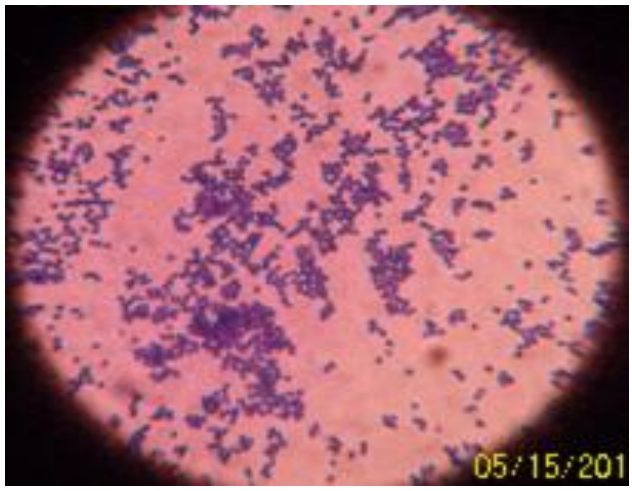
***Ulocladium* sp.**

Fusarium sp.

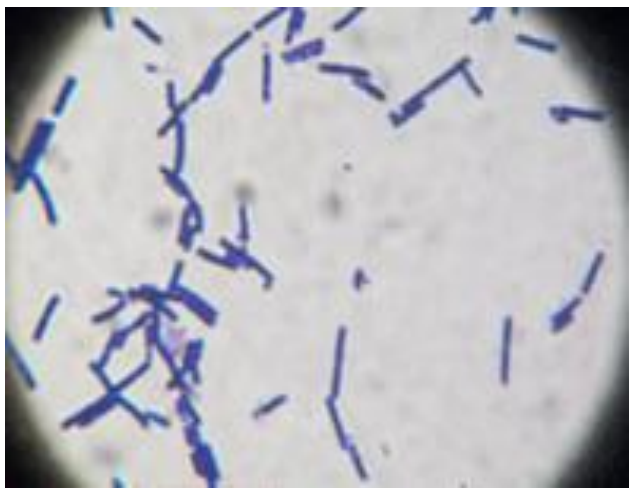
Fig. 1. Shows the microscopy photograph of some fungal species isolated from the indoor environment.



Micrococcus luteus



Staphylococcus aureus



Bacillus subtilis

Fig. 3. Shows the microscopy photograph of some bacterial species isolated from the outdoor environment.

Table 8. Growth of microorganisms and their characteristics on SDA from garden.

S. No.	No. of colonies	Diameter (mm)	Color	Shape	Texture	Elevation	Organisms
1.	28	5-22	White	Irregular	Rough	Yes	*Scedosporium aurantiacum*
2.	10	5	Cream	Round	Rough	Yes	*Fusarium* sp.
3.	9	3	Yellow	Round	Rough	Yes	*Microsporum* sp.
4.	15	7	Orange	Irregular	Rough	Yes	*Alternaria alternata*
5.	21	6-19	Black	Irregular	Rough	Yes	*Aspergillus niger*
6.	7	3-10	Brown	Irregular	Rough	Yes	*Ulocladium* sp.
7.	29	2-7	Light green	Round	Rough	Yes	*Aspergillus flavus*
8.	12	2-5	Pink	Round	Rough	Yes	*Fusarium* sp.

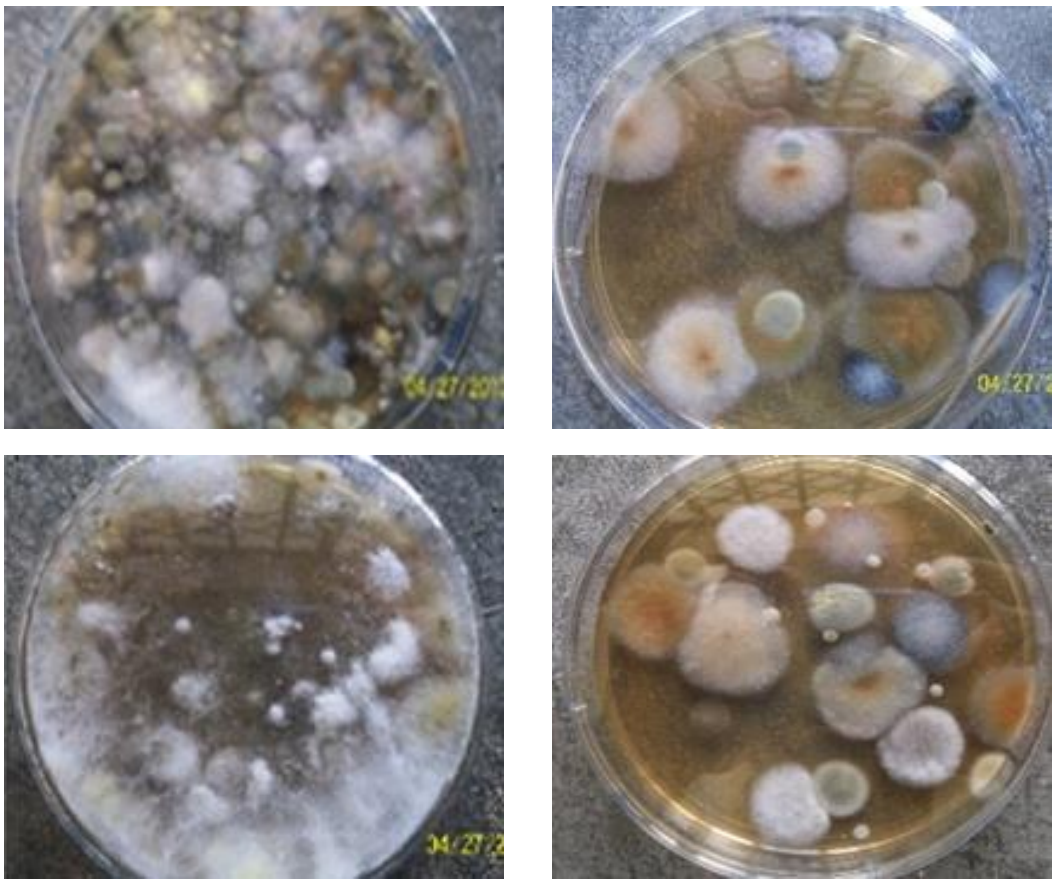


Fig. 4. Shows the photograph of different fungal colonies isolated from the atmospheric environment.

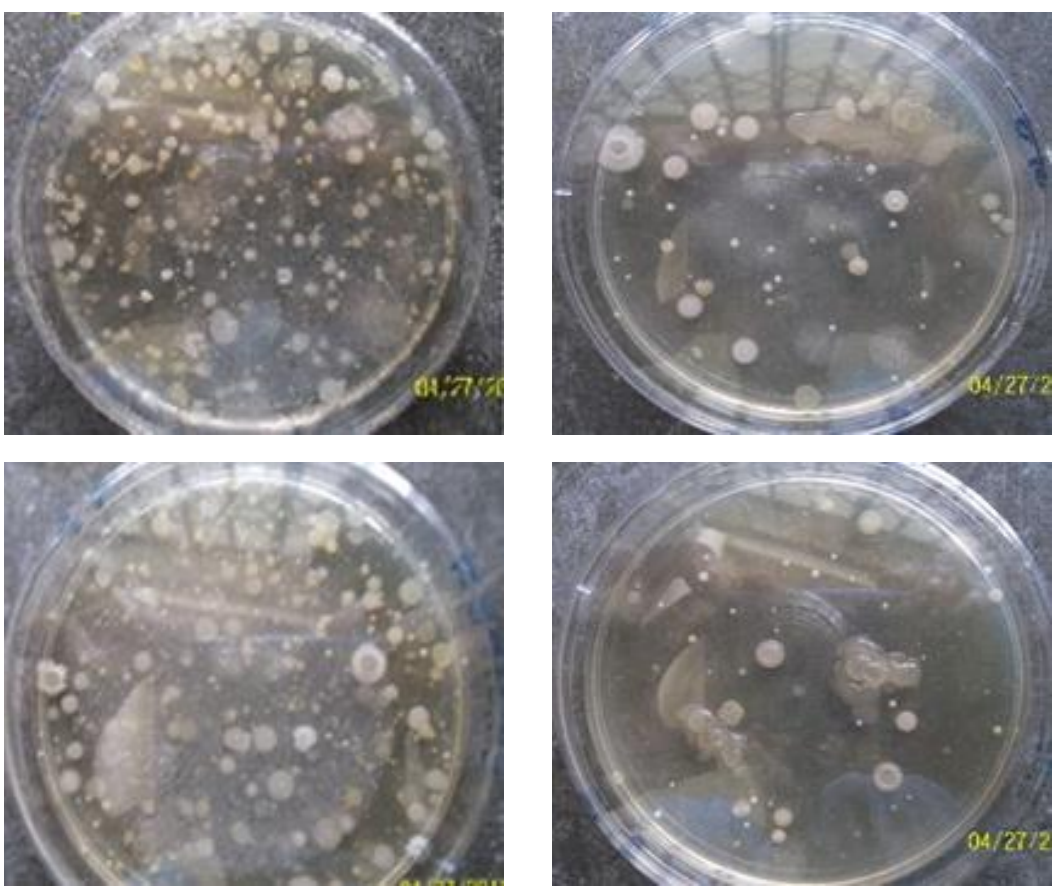


Fig. 5. Shows the photograph of different bacterial colonies isolated from the atmospheric environment.

The result indicates that a broad range of fungal and bacterial growth present in outdoor and indoor environment. We isolated almost 08 different fungal species and nearly 06 bacterial species that are found in the atmospheric surroundings (Figs. 1-4).

Discussion

According to Jones & Harrison (2004), a wide variety of biotic and abiotic processes may interact to enhance microbial distribution in the aura. In this experiment the result clearly showed that the microbial density of outdoor air is significantly higher than the indoor air and this might be due to the use of disinfectant and antiseptic materials in the indoor environment for cleaning purposes through sprays and apply directly on the surface that would have limited the population of microbes in the air, but the outdoor environment served as feeding ground for these microbes because where they get all the desired materials in adequate quantity.

Conclusion

In the present study it was found the level of bacteria and fungi in the atmosphere was quite alarming the most dominant fungal species belonged to the genera *Aspergillus, Scedosporum* and *Mucor*, while the most dominant bacterial species were of the genera *Bacillus, staphylococcus* and *Micrococcus*. This indicates that the microbial population in air is greater both indoor and outdoor surroundings and they may play a critical part in inducing disease in living organisms.

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