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Evaluation Microbiological Air Contamination in Al Majmaah University

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Abstract: ***The presence of the bacteria in air indoors is a problem from the view of health protection. to estimate the health hazard and to create standards for indoor air quality control, the determination of indoor microorganisms is necessary, and it is especially important in such populated areas like education places and hospitals. In this study we studied the level of microbial contamination in various areas in the buildings of applied medical science /girls departments in Al Majmaah University, KSA. The air samples were collected from five different locations during October-November 2014. Air samples were taken twice a day: in the morning and in the afternoon. Most frequently isolated bacteria were gram positive bacilli 36%, staphylococcus sp. 24%, Gram negative bacilli 21%, and gram positive cocci 18%.***

Keywords: Bacteria, Gram positive, gram negative, Airborne, *staphylococcus sp*.

1. Introduction

Indoor air quality is one of the most significant factors that affecting the health of the indoors people who inhale every day, those people spend between 80-95% of their lives indoors [2]. The microorganisms and their by-products can result in respiratory disorders and other adverse health effects such as infections, hypersensitivity pneumonitis and toxic reactions [14]. The air inhaled by people is abundantly populated with microorganisms called bio aerosol [28].

Biological contamination of indoor air is mostly caused by bacteria, moulds and yeast. They can be dangerous as pathogenic living cells but they can also secrete some substances harmful for health [8], [4], [23]. Depending on Epidemiological studies the high concentration of microorganisms in the air can be allergenic; however, sometimes even very low concentrations of some particular microorganisms can cause serious diseases. It it supposed that the human organisms reaction in 30% of health problems relevant to the indoor air quality [15]. particularly in rooms with ventilation and air-conditioning, heating systems [4], [9], [11], [15], [20], [29] can breed allergies [8], [10], [19], [30], also the symptoms wich causing irritation of mucous membranes, vertigo, tiredness, headaches, bad physical condition, decrease of concentration, memory and intellectual work ability are called Sick building syndrome (SBS) [15], [21], [30], also asthma and respiratory diseases [8] – [10], [18], [15] and cancers [8], [19], [15], [18], [7] may a result of bad air quality. The amount of the pathogenic microorganisms is higher in indoor compared with outdoor air [2], [4], [13], [22]. Microbial damage is caused most frequently by bacteria and molds. These micro-organisms can enter indoor areas either by means of ventilation systems used indoor or by means of passive ventilation. Many bacterial genera are also emitted by indoor sources like flower pots, food, animals and wastebaskets. In most cases normal flora, are not harmful. However, growth conditions like excessive humidity and/or a high water content of building materials are encountered on a more frequent basis, which in most cases can be described as the limiting factor for microbial growth. This caused as a result of the incorrect behavior of users of rooms such as the short comings of the lack of thermal insulation in the buildings. The relative humidity and/or the moisture content of the materials determines the ability of different microorganisms are able to grow on indoor or outdoor materials [3].The aim of this study is to observe the microbiological quality of indoor air in selected rooms and laboratories of university buildings located in Applied medical science girls department of Al Majmaah university, where hundreds of students spend several hours studying and working in enclosed spaces every day and where microbiological quality of indoor air can influence their health and physical condition.

2. Materials and Methods

2.1 Description and location:

Al Majmaah city is located in the middle of Saudi Arabia Kingdom. The flat, Najed desert covers the city. Have no natural lakes or water reservoirs. There is no difference between the country's highest and lowest points, and the high of the city ranged 697- 738 m above sea level.

The climate of Al Majmaah is arid continental climate. The summer season, which lasts from May to September, is extremely dry and hot with temperatures easily exceeding 45°C during daytime. Al Majmaah has a fairly high temperature range and it has day-night temperature difference. Winter's season lasts from November through February, is cool with some precipitation and average temperatures around16 °C with extremes from 0°C to 24°C.

2.2 Sampling sites.

This study conducted during October-November 2014. The study embraced a measurement of the concentration of bacteria in the air of selected rooms and biochemical laboratory and microbial composition of the air. Sampling location is applied of medical science, girls departments Al Majmaah University (MU), located in Al khaldiya area. Sampling was conducted in the building of the University (lecture rooms, cafeteria, biochemistry laboratory, and internal corridor) which they are part of the building complex on the campus of Al Majmaah University. The samples were collected twice a day in the early morning 7:30- 8:00AM before the students and staff started work in order to determine indoor background, and at 12:00- 12:30 PM where the college is crowded with the highest number of students and academic teachers used the Rooms and laboratories. All the samples were taken without controlling any indoor environmental conditions. Detailed specifications of examined are are presented in Table 1.

Table 1: Detailed of examined areas

Investigated Rooms	Characteristic of Rooms		
	Area [m^2]	Cubature [m^3]	Number of students
Class Room 3	68	212	45
Class Room 2	53	163	35
Biochemistry Laboratory	60	179	25
Internal Corridor	24	82	….
Cafeteria	953	3183	….

Air samples were taken using Spin air sampler, based on the principle of the Andersen air sampler. Tested volumes of the air were 100 liters and the sampling rate – 100 l/min. Bacteria were collected and grown on standard culture media Tryptic soy agar (TSA) with supplemented with cyclohexamide which inhibits the growth of fungi, Petri dishes were incubated for 24h at 37 ^{o}C. Plates then counted and identified the colonies on each plate. The average number of bacteria was calculated as colony forming units in 1 m^3 (CFU/m^3). Total microbial count was corrected using the conversion formula devised by Feller [6]:

Pr= N [1/N + 1/N-1 + 1/N-2+....+1/N-r+1]

where:

N= 400 (number of holes in perforated lid of the sampler).

r - Number of CFU counted on Petri dish.

Pr - statistically corrected total count of bacteria in tested air volume.

Identification of bacteria by cultural analysis is based on morphology spherical by staining reactions [5], [24], [25], and by the pattern of results from a series of Biochemical Testing of Micro-organisms and Medical Laboratory; Manual for Tropical Countries and conventional and biochemical methods [1]. Parameters such as relative humidity, temperature and number of people in the object were determined simultaneously with each microbial sample.

3. Results and Discussion

This study was conducted in Applied medical science/ girls department in Al Majmaah university during October-November 2014, The Temperature ranged between 18°C and 25°C, and the air humidity was about 50-72%.

Results were reported as the number of CFU per cubic meter of air (CFU/m^3). The number of microorganisms expressed as CFU/m^3 was estimated according to the equation a variety of organism species is grown. The levels of occurrence of the bacteria identified in the indoor air from five different areas: class room1, class room 2, biochemistry lab, cafeteria and internal corridor.

The highest level of bacteriological contamination was detected in the cafeteria and in the class rooms after the lectures, corridor, biochemistry laboratory respectively, and before the lessons started the number of microorganisms were much lower.

Table 2: Microbiological air contamination inside the study areas

Investigated rooms	Sampling time	Total number of bacteria [cfu/m^3]	Temperature ˚C	Humidity %
Class room 3	Morning	3.3×10^2	14	76
	afternoon	4.2×10^2	24	56
Class room 2	Morning	2.7×10^2	18	72
	afternoon	3.6×10^2	25	50
Biochemical laboratory	Morning	2.4×10^2	18	72
	afternoon	2.9×10^2	20	50
Internal corridor	Morning	2.7×10^2	24	76
	afternoon	3.5×10^2	24	50
Cafeteria	Morning	3.8×10^2	18	67
	afternoon	5.2×10^2	24	50

The guidelines in Saudi Arabia kingdom focus on providing a comfortable environment, so all the buildings are air-conditioned for most of the year. Ventilation is one of the key factors which affects particle deposition rates indoors [16], [17], [26]. And this can explain the high proportion of bacteria of this study. The percentage of isolated bacteria present in table 3.

Table 3: The percentage of isolated bacteria

Gram positive bacilli	Staphylococcus Sp.	Gram negative bacilli	Gram positive coccus
36%	24%	21%	18%

The bacterial concentration measured during the study period were significantly high because the students in KSA universities spend most of their time in closed areas as a result of extreme weather conditions. The isolated colonies from indoor air pollution are shown in Table 4 in the five areas and an abundance of bacteria which detected. The highest culture of bacteria was observed in the cafeteria gram positive bacilli followed by *Staphylococcus sp.* 31%, Gram positive bacilli 29%. Among predominant genera of bacteria. Increased culture ability of bacteria inside the cafeteria may have serious implications because of the potential increase the pathogenicity of viable bacteria on immunocompromised individuals. Microbial flora of indoor air depend on several factors, including the number and hygienic standard of people present, the quality of the mechanical movement within the enclosed space [12], In crowded domiciles, the

higher number of residents confined to a small space result in the build-up of airborne microbes shed by the human body.

Table 4: The numbers of most common bacteria appearance in five areas

Organism	area				
	Class room 3	Class room 2	biochemistry laboratory	internal corridor	Cafeteria
gram positive bacilli	23%	17%	11%	20%	29%
Staphylococcus spp	24%	17%	10%	18%	31%
gram negative bacilli	28%	18%	11%	16%	27%
gram positive coccus	26%	15%	12%	19%	28%

the high diversity of microorganisms appeared in the cafeteria area compared to the laboratory, The reason for this is the number of the students and the temperature and relative humidity are closely associated with microbial growth, and The majority of students prefer to stay at the cafeteria to have coffee, breakfast, , the concentration of total bacteria was high in the small areas with lot of people as when the concentration of bacteria for the other different areas were less compared to the bacterial concentration in the cafeteria although the remaining food in the cafeteria encourage the microbial growth.

4. Conclusion

The microbiological quality of the air in investigated areas showed that the concentration of bacteria more increased in the afternoon after the students and the faculty staff started their duties, it is clear that high contamination of indoor air at study area constrain a serious problem both from the point of view of health protection. This result proves the importance developing standards of indoor air quality related to microbial pollution for educational settings for the health safety of both students and the academic staff.

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