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RESEARCH ARTICLE

Identification and Characterization of Bacteria Air Pathogens from Homes in Some Areas of the Baghdad City

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Abstract

To identify the different risks and to establish exposure thresholds, microbiology of air samples from a series of indoor environment should be characterized; and the different microorganisms must be identified and characterized.

This research title, identification and characterization of bacteria air pathogens present in the air that could constitutes health risk to the inhabitants of these houses. A total of six bacterial pathogens were identified from the ten samples collected from ten zones, comprising of *Staphylococcus* spp., *Bacillus* spp., *Escherichia coli*, *Salmonella* spp., *Shigella* spp., and *Pseudomonas* spp.

Staphylococcus spp., had the highest percentage of concern 95%, followed by *Bacillus* spp. 75%, *Escherichia coli* had 70%, while *Pseudomonas* had 50%, and the least was *Sallmonella* spp.and *Shigella* spp.had 30%, and 20%.

Considering the fact that some of the isolated pathogenic bacteria are associated with gastrointestinal tract infection(*Salmonella* spp., *Shigella* spp., *Escherichia coli*, *Bacillus* spp., and *Staphylococcus* spp.) which could be through ingestion of food or water cotaminated by these pathogens and also respiratory tract infection(*Pseudomonas* spp.) constitute a great concern to health practitioners in developing countries because these are pathogens that are mostly resistant to the commonly avialable antibiotics used in the treatment of infection asociated with these pathogens.

INTRODUCTION

Indoor air quality (IAQ) has become a matter of growing concern over the past of two decades [1]. In the past, most people just paid attention to the significant health effect caused by the outdoor air pollution; however, the exposure to the indoor pollutant by human has been increasing. According to the United States Environmental Protection Agency(USEPA), the level of pollutants in the indoor environment may be 2-5 times, and occasionally more than 100 times, higher than the outdoor levels [2].

Microorganisms are widespread and mixtures of microbes are often transferred to everyday objects from the environment and infected individuals. Pathogenic microbes are transmissible via air, skin, food, water, and other interpersonal contact and in most cases they cause disease and infections [3].

Bacterial populations can be cultured from air samples (culture plate), from surface (swabs, contact plates, etc), and from bulk sample (water sample, pieces of solid material, dust, etc.) [4].

Airborne particles are a major cause of respiratory ailments of humans, causing allergies, asthma, and pathogenic infections of the respiratory tract. [5]

Transmission of these infectious agents typically involves their escape from the host and entry into a new host [6, 7].The importance bioairosols has been emphasized in recent decades due to their effect on human health. They have been implicated in conditions ranging from allergies to disseminated infections in susceptible patients [8].
Aerosols are liquid or solid particles suspended in a gaseous medium with size range from 0.001 to 100μm. [9]
Bioaerosoles consists of aerosols containing microorganisms (bacteria, fungi, viruses) or organic compounds derived from microorganisms (endotoxins, metabolites, toxins, and other microbial fragments) form a significant portion of atmospheric aerosols, sometimes reaching close to 50% numerically of all aerosols particles [10].
Bioaerosoles vary in size (20nm to>100 μm) and composition depending on the source aerosolization mechanisms, and environmental conditions prevailing at the site [11].
Most of these bacteria are shed from human skin surfaces. It is not surprising to find hundreds of thousands of bacteria per grams of dust in carpet. As long as the bacterial types are a mixture of (*Staphylococcus sp., Micrococcus sp., Bacillus sp.)* there is generally no cause for concern.
Among the *Staphylococcus* species that are commonly found indoors is *Staphylococcus aureus,* which is an important pathogen in hospital environments [4].
In the environment spores of molds and bacteria may become airborne and are therefore widespread. They can enter indoor areas either by means of passive ventilation systems. Many genera are also emitted by indoor source like animals, and wastebasket.
In most cases, normal flora is not harmful. However, growth condition 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 [12].
This is caused by shortcoming of the building such as the lack of thermal insulation, as well as the incorrect behavior of users of rooms. This relative humidity and /or the moisture content of the materials determines that to what extent different microorganisms are able to grow on indoor or outdoor materials [13].
Automated techniques are only efficient in quantitative analysis, and limited use because they require heavy and noisy equipment and need constant power supply [14].
The passive sedimentation technique is also limited because it does not permit an appropriate quantitative analysis, but it is still widely recommended in the literature for use as microbiological alert [6].
To access and manage environmental health risks, such as air pathogens, the need to continuously carrying out research into the effect and impacts of air pathogens on health remains critical which is often lookout most especially the health impact of indoor air pathogens sources.
Looking at the high population in Baghdad, the present study is aim at isolating air bacteria pathogens in Baghdad city.

Material and Method:

Sample collection:

Sample collection was performed using the passive sedimentation method in 150mm diameter petri dishes containing nutrient agar, salmonella/shigella agar, and macConkey agar and eosin methylene blue (EMB) agar media.
The plates were exposed in each of the environments for two hours in each period, positioned 2m high roughly human respiration height [15], close to an open window.

Preparation of media:

Four media namely, nutrient agar, salmonella/shigella agar, macConkey agar and eosin methylene blue (EMB) agar, were prepared based on manufacturer instruction.
In order to test for sterility of the prepared media, the petri dishes containing the different sterilized agar media were further incubated without any inoculation in the incubator for 24hours.
Petri dishes having no growth of microorganisms (contamination) were used for sample collection.

Identification of bacteria:

The genera of all the cultured airborne bacteria were identified according to the classification method of Bergey's manual [18].
After gram's staining of bacteria, additional identification was carried out by conducting biochemical test through the automated microbial identification system, VITEK (model ViTEK 32 system, biomerieux Inc., France).

Result.

Table and figure legends

1. **Table (1) the growth of bacteria on the media.**
2. **Table (2) percentage of isolated bacteria in ten samples collected.**
3. **Figure (1) the percentage of isolated bacteria in ten samples.**

Table (1):The growth of bacteria on the media

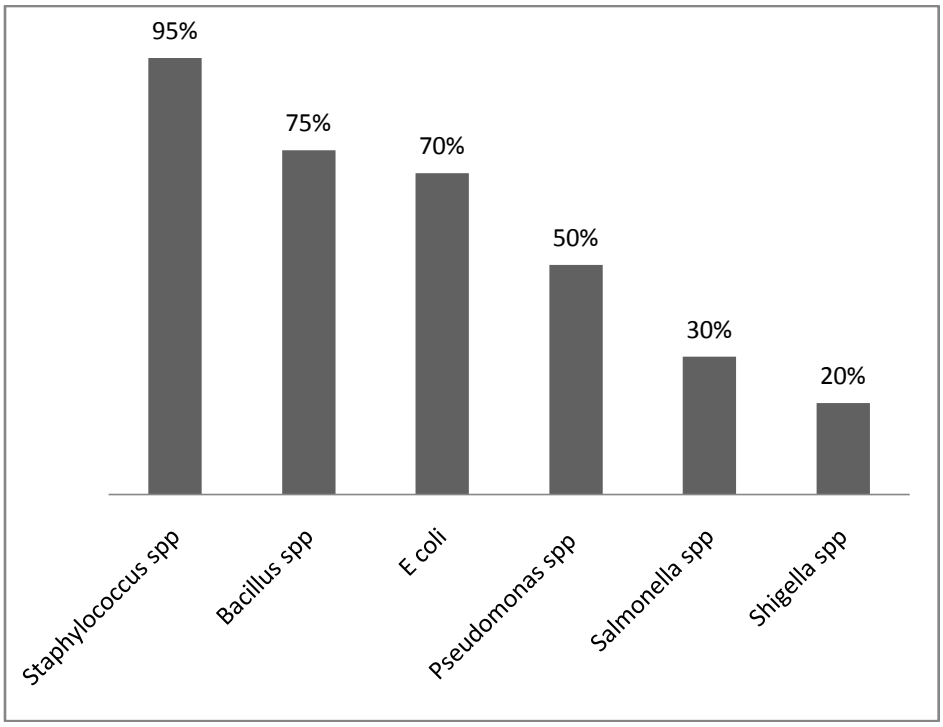
sample	Nutrient agar	macConkey agar	Salmonella shigella agar	Eosin methylene blue (EMB) agar
1	+++	++	++	++
2	+	-	-	-
3	+++	+	-	+
4	+++	++	+	+
5	+++	+	-	+
6	++	+	-	+
7	+++	-	-	-
8	++	+	-	-
9	++	+	+	+
10	++	+	-	+

(+++) high growth
(++) medium growth
(+) low growth
(-) no growth

Table (2): Percentage of isolated bacteria in ten samples collected.

Isolated organisms	percentage
Staphylococcus spp.	**95%**
Bacillus spp	**75%**
E.Coli	**70%**
Pseudomonas spp	**50%**
Salmonella spp.	**30%**
Shigella spp.	**20%**

Figure (1): The percentage of isolated bacteria in ten samples.



Discussion:

From the result represented above, a total of six bacteria pathogens were isolated comprising of *Staphylococcus spp., Bacillus spp., E Coli, Pseudomonas spp., Salmonella spp., and Shigella spp.,*
Staphylococcus spp. has the highest percentage of 95%, followed by *Bacillus spp.* 75%, *E coli* recorded a percentage of 70%, and *Pseudomonas spp.* has 50%, while *Salmonella spp. and Shigella spp.* recorded 30% and 20%.
From the result of research conducted, it is observe that *Staphylococcus spp.* and *Bacillus spp.* has the highest percentage in each of the sampling zones. This is true, looking at the fact that these bacterial pathogens are commonly associated with gastrointestinal infections as a result of eating food contaminated by these pathogens. Also another gastrointestinal pathogens *E coli* (70%) and *Salmonella spp.*(30%), isolated are of concern because these bacteria pathogens is the causative agent of bacterial diarrhea in most developing countries today, especially among children. Also another gastrointestinal pathogens *Shigella spp.* (30%) isolated is of concern because these bacteria pathogens is the causative agent of bacillary dysentery in most developing countries today, which could be fatal in children if not diagnose and treated on time.
The isolation of *Pseudomonas spp.* in 4 out of 10 zones is of great concern too, looking at the fact that these bacterial pathogens are associated with respiratory tract infection that if left untreated could be life threating both in children and adult as reported by [16,17,12].
In addition, the bacteria isolated were usually of human and soil origins. The bacteria that come from human are mainly from the skin and respiratory tract, and were released by occupants into the sites through shedding off from skin, sneezing or talking; whereas the soil bacteria were usually dispersed in the air by dust. Therefore, the bacteria isolated from the sampling sites were contributed by human and the outdoor environment.

Conclusion

Exposure to bioaerosoles has already been associated with a wide range of health effects such as e.g. infections disease, acute toxic effects or allergies.

Owing to the ubiquitous presence of airborne microbes in nature, they are essentially present in most enclosed environments [18].

The isolation of gastrointestinal pathogens (*Staphylococcus spp., Bacillus spp., E Coli, Pseudomonas spp., Salmonella spp., and Shigella spp.),*and respiratory tract pathogens (*Pseudomonas spp.)* from houses of Baghdad city constitute a great concern to the health of the inhabitants residing in Baghdad because these bacterial pathogens could be life threatening both in children and adult if not diagnose on time and appropriate antibiotic administered to treat these infections associated with these pathogens. Also considering the fact that these pathogens were isolated from areas close to the windows, this further suggest that proper ventilation system should be provided when constructing houses to permit the in –flow and out-flow of air in our homes in other to minimized not only the concentrations of pathogenic bacteria in our homes but also chemical substance, increasing the ventilation rate by means of mechanical or natural systems can play a role in improving the indoor air quality.

Finally, this research focus on the isolation of bacterial pathogens alone, but there is the need to carried out further research with the view to find out the possibilities of isolating fungal pathogens which could be a good source of air pathogens and also to evaluate these microbes (bacteria and fungi) against some of the commonly used antimicrobial agents used in the treatment of infections associated with these pathogens.

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Supplementary material:

- Four media namely, nutrient agar, salmonella/shigella agar, macConkey agar and eosin methylene blue (EMB) agar.
- Gram's staining.