Potential Bacterial Contaminants in the Handles of Car Doors

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Abstract

The prevalence of bacterial presences on the handles of car doors in Al-Najaf Province was evaluated. The current study was carried out between December 2017 and March 2018. A total of 100 samples were collected and cultured for bacterial isolation. The incidence of positive specimens was as the follow; (40%) with bacterial cultures, (52%) with yeasts cultures and (8%) with negative aerobic cultures. In addition, the current results involved that (70%) of isolates was Gram positive and (30%) of isolates was Gram negative. The most isolated bacteria were S. aureus, Klebsiella sp., E. coli, Proteus sp., Salmonella sp., Bacillus sp., and Streptococcus sp. The current study was indicated high prevalence rate of bacteria on the handles of car doors in Al-Najaf Province.

Keywords: Bacterial contamination; Infection; Door Handles; Infectious diseases.
INTRODUCTION

The Handles of car doors are one of the most important environmental places for microbial infection and disease transmissions through a direct contact on a daily basis\textsuperscript{1,2}.

In previous studies, the prevalence of microbial contamination on indoor environmental places such as homes, offices and restaurants was at high level. Now, many studies indicate that the source of these microbes is the pollution of the external environmental places and its transfer to the interior in many ways, most notably through direct contact\textsuperscript{3,4,5}.

There are many bacterial species on the contaminated solid surfaces, which frequently used such as handles of car and house doors. The most important of these bacterial species are belonging to genus of \textit{Staphylococcus}, thus it represents one of the most important sources of infection. Naturally, \textit{Staphylococcus} sp. colonize human skin and thus easy access to such places, making it a focus of microbial contamination and increased possibility of disease because of the arrival of these bacterial contaminants to places other than their natural places\textsuperscript{6,7,8,9}.

In addition, several studies have indicated the possibility of transmission of diseases through a variety of tools, such as the towels, razors, children’s toys, stairs, switches and other elevators\textsuperscript{10,11}. Recently, nano-silver particles, are anti-microbes, and characterized by low toxic, low-cost, environmentally friendly and harmless, have been used in making of handles of car doors.

Furthermore, the handles of copper doors can kill some microorganisms such as bacteria and fungi; therefore, it is preferable to make the handles of door from copper. As a result of contact with these surfaces might be contaminated with dangerous pathogens, personal hygiene and hand washing are most important ways to avoid microbial infection\textsuperscript{12}.

MATERIALS AND METHODS

Sample collection

A total of (100) samples from handles of car doors was collected using sterile swabs that were transferred to the laboratory within half an hour. All samples were diluted with saline solution. From each, 0.1 ml has been taken for culture on some selected culture media\textsuperscript{13}.

Samples processing

For the purpose of counting and diagnosing of the bacteria that cause contamination of the handles of car doors, all samples were processed according to the following steps: culture, counting of the colonies using the colony counter device, gram stain and biochemical tests.

Isolation and identification

All culture media were prepared according to instructions of the manufacture and sterilized at 121° C and 15 lb / 2 g for 15 minutes\textsuperscript{14}. Biochemical tests were performed using API20 tapes according to instructions of manufacture (BioMerieux).

RESULTS

The current study showed contradictory results among collected samples that have been taken as shown in table (1). The percentage of positive bacterial culture and yeast culture were (40%) and (52%) respectively, while the percentage

![Bar chart](attachment:bar_chart.png)

Fig. 1. Bar chart of percentage distribution for positive culture media (bacteria and yeast).
### Table 1. Counting of bacterial colonies on the contaminated handles of car doors.

| No. | Sample No. | Mean of Colonies |
|-----|------------|------------------|
| 1   | S-1        | 300              |
| 2   | S-2        | 0                |
| 3   | S-3        | 50               |
| 4   | S-4        | yeast            |
| 5   | S-5        | 300              |
| 6   | S-6        | yeast            |
| 7   | S-7        | yeast            |
| 8   | S-8        | 25               |
| 9   | S-9        | 15               |
| 10  | S-10       | 30               |
| 11  | S-11       | yeast            |
| 12  | S-12       | yeast            |
| 13  | S-13       | 150              |
| 14  | S-14       | yeast            |
| 15  | S-15       | yeast            |
| 16  | S-16       | 20               |
| 17  | S-17       | 0                |
| 18  | S-18       | yeast            |
| 19  | S-19       | yeast            |
| 20  | S-20       | 300              |
| 21  | S-21       | 75               |
| 22  | S-22       | 75               |
| 23  | S-23       | yeast            |
| 24  | S-24       | yeast            |
| 25  | S-25       | 50               |
| 26  | S-26       | 100              |
| 27  | S-27       | yeast            |
| 28  | S-28       | 75               |
| 29  | S-29       | 200              |
| 30  | S-30       | 200              |
| 31  | S-31       | 200              |
| 32  | S-32       | 15               |
| 33  | S-33       | 75               |
| 34  | S-34       | 300              |
| 35  | S-35       | 300              |
| 36  | S-36       | 100              |
| 37  | S-37       | 200              |
| 38  | S-38       | 75               |
| 39  | S-39       | yeast            |
| 40  | S-40       | 200              |
| 41  | S-41       | 75               |
| 42  | S-42       | 25               |
| 43  | S-43       | 200              |
| 44  | S-44       | 100              |
| 45  | S-45       | 200              |
| 46  | S-46       | 35               |
| 47  | S-47       | 75               |
| 48  | S-48       | 0                |
| 49  | S-49       | 100              |
| 50  | S-50       | 300              |

### Table 1. continues...

| No. | Sample No. | Mean of Colonies |
|-----|------------|------------------|
| 51  | S-51       | yeast            |
| 52  | S-52       | yeast            |
| 53  | S-53       | yeast            |
| 54  | S-54       | yeast            |
| 55  | S-55       | yeast            |
| 56  | S-56       | yeast            |
| 57  | S-57       | yeast            |
| 58  | S-58       | yeast            |
| 59  | S-59       | yeast            |
| 60  | S-60       | yeast            |
| 61  | S-61       | yeast            |
| 62  | S-62       | yeast            |
| 63  | S-63       | yeast            |
| 64  | S-64       | yeast            |
| 65  | S-65       | yeast            |
| 66  | S-66       | yeast            |
| 67  | S-67       | yeast            |
| 68  | S-68       | yeast            |
| 69  | S-69       | yeast            |
| 70  | S-70       | yeast            |
| 71  | S-71       | yeast            |
| 72  | S-72       | yeast            |
| 73  | S-73       | yeast            |
| 74  | S-74       | yeast            |
| 75  | S-75       | yeast            |
| 76  | S-76       | yeast            |
| 77  | S-77       | yeast            |
| 78  | S-78       | yeast            |
| 79  | S-79       | yeast            |
| 80  | S-80       | yeast            |
| 81  | S-81       | yeast            |
| 82  | S-82       | yeast            |
| 83  | S-83       | yeast            |
| 84  | S-84       | yeast            |
| 85  | S-85       | yeast            |
| 86  | S-86       | yeast            |
| 87  | S-87       | yeast            |
| 88  | S-88       | yeast            |
| 89  | S-89       | yeast            |
| 90  | S-90       | yeast            |
| 91  | S-91       | yeast            |
| 92  | S-92       | yeast            |
| 93  | S-93       | yeast            |
| 94  | S-94       | yeast            |
| 95  | S-95       | yeast            |
| 96  | S-96       | yeast            |
| 97  | S-97       | yeast            |
| 98  | S-98       | yeast            |
| 99  | S-99       | Yeast            |
| 100 | S-100      | Yeast            |
of no growth culture was (8%), it seems that microbial contamination was very high in the surfaces of the handles of car doors in the present study.

**DISCUSSION**

The handles of car, house, and office doors, are one of the most important sources of infection among users because different people repeatedly use them. The current study has shown important levels of contamination with different positive and negative gram stain bacteria. The bacterial incidence was 70% for gram positive and 30% for gram negative (Fig.2), indicating that the majority of these bacteria are human skin's microbiota1.

In view of the current results, the levels of microbial contamination of handles of car doors was high and the percentage of positive bacterial culture and yeasts were 40% and 52% respectively, while the percentage of negative samples was (8%), which foreshadows the possibility that these surfaces are a big source of infection.

Some isolated bacterial species (Fig.3) were attributed to human pathogenic groups such as *S. aureus*, *Klebsiella* sp., *E. coli*, *Proteus* sp, *Salmonella* sp., and *Bacillus* sp, and other were an opportunistic pathogens such as *Staphylococcus* sp., and *Streptococcus* sp. The current results were in consistent with results of 15,16.

Most of the gram-negative bacterial species were Enterobacteriaceae, indicating the contamination of these handles with faeces, where might cause food-borne diseases, urinary tract infections, or bronchial diseases. As well as the possibility of increased risk of skin diseases, inflammation of burns and wounds, gastroenteritis, diarrhea and other pathological injuries12.

The results of the current study were in agreement with previous studies that indicated the possibility of contamination of solids, such as handles of home doors and office doors, with opportunistic and pathogenic bacteria. Our results were closed to those found by Nworie and his colleagues17, and Onwubiko and Chinyeaka18 and inconsistent with another study conducted by Otter and French19.

The current study showed a significant variation in the number of isolated bacteria from various handles car doors. These results were consistent with study of Boone and Gerba20 and Nworie and his colleagues17, who demonstrated that the levels of contamination of door handles depends on the rate of use and exposure to environmental factors such as heat, drought and other environmental factors.

The majority of gram-positive bacteria (Fig. 2) were belonged to *Staphylococcus* and *Streptococcus*. In fact, the most of the endemic bacteria of human skin belong to *Staphylococcus* and *Streptococcus*. This is in agreement with previous studies indicating the role of normal flora in contaminating the most important solid surfaces17,21,22.

The presence of *Bacillus* bacteria with high rates in the handles of car doors in the current study (Fig.3) was mainly to the fact, that these bacterial species able to resists hard environmental conditions through the formation of internal
spores, which have the ability to germinate and grow again, when the appropriate conditions. Dramatically, Brooks and his colleagues was referred to the spread of *Bacillus* sp, in the handles of house doors.

The present study confirmed that the current healthy procedures in the study sites were not of the required level. This may be due to the fact that most users of handles of car doors do not know the seriousness of the matter or do not know the possibility of transmission of many diseases by direct contact.

For real and effective intervention to support public health at the governmental and civil levels, it is essential highlight the importance of the subject through organization of lectures, workshops, and educational sessions.

When users are aware of the risk of transmission of many diseases from the surfaces of handles of car, homes and offices doors, this will greatly help to reduce the spread of many transitional diseases, whether bacterial or fungal and thus contribute to the promotion of public health.

It is clear that the role of personal hygiene through the importance of washing hands and the use of disinfectants and avoid eating foods without making sure to wash hands and other ways to reduce the spread of transitional diseases.

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