

# Inhibition Rates of Disinfectants on Bacterial Isolated from Student Dormitory

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## Abstract

**Background:** Although most of human life is spent inside, where bacteria are always present on things, little is known about the microbial variety of indoor habitats. **Objectives:** The major objective of this study was to determine the rate and types of bacterial contaminants in female and male student dormitory of Al-Kufa university campus, and to explore the inhibitory effect of certain disinfectants. This study was conducted for the period from October 2022 to Jun 2023. A total of 400 bacteriological swabs were collected aseptically from different sites of male and female student dormitory of Al-Kufa university. Swabs were streaked as soon as possible on blood agar and MaConkey agar plates and incubated overnight. Identification of bacterial species was based on standard bacteriological criteria. The inhibitory effect of 40% and 60% concentrations of three commercially available disinfectants; dettol (chloroxylenol), Al-Emlaq (Alkyl benzene sulfonate), and the house bleach (sodium hypochlorite) were explored by agar diffusion method. Data were statistically analyzed.

**Results:** The results revealed that the overall bacterial contamination rate in student's dormitories of Al-Kufa university campus was 78%. Male dormitory unit had significantly higher contamination rate compared to female dormitory unit (57.5% vs 42.5%). *Bacillus* spp. Was the most predominant contaminant in both male and female units. Al-Emlaq super gel (Alkyl benzene sulfonate) was found as the most effective disinfectant against the majority of bacterial isolates.

**Conclusion:** Authorized and public awareness toward bacterial contamination in student's dormitories is recommended. The selection of an effective disinfectant should be based on its active ingredient and concentration.

**Keywords:** Bacterial contamination, Disinfectants, Dormitories.

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## INTRODUCTION

Dormitories at universities serve as places for students to live. In addition to providing them with opportunities to develop their own character, intelligence, and life skills, these are the areas where students live, study, and sleep the most of the time. So, a healthy interior environment is required in the residence halls in order to create a favorable environment for students, improve their performance, and assist the university in fulfilling its primary goal of teaching students (Diba *et al.*, 2019; Radhi, 2019; Rahim *et al.*, 2023).

The indoor environment has a substantial impact on human health. Furthermore, microbiological quality of environments is an important criterion that must be taken into account when indoor workplaces are designed to provide a safe environment. Contaminations by pathogenic or potentially pathogenic bacteria

constitute a real problem on the levels of public as well as health care settings (Diba *et al.*, 2019; Radhi *et al.*, 2022). Uncontrollable transmission of communicable pathogens is responsible for the emergence of community acquired and nosocomial infections (Hasan *et al.*, 2008; Radhi *et al.*, 2022).

Moreover, the evolution of antibiotic resistant bacteria is a worldwide awareness now a day. Several studies had conducted to determine the prevalence of bacterial contaminants in student dormitories and to find out the suitable preventive measures reducing bacterial contamination (Li *et al.*, 2020; Akanda, *et al.*, 2024; Almkhadhree, *et al.*, 2023).

Application of dettol (Chloroxylenol), Alkyl benzene sulfonate, and house bleach (sodium hypochlorite) as bacterial disinfectants in domestic and health care settings had yielded variable results (Digison, 2007; Wilson and Mowad, 2007; Ogbulie *et al.*, 2008;

Radhi, 2020; Lin *et al.*, 2020; Basiry *et al.*,2022). Therefore, the present study was conducted to document the rate of bacterial contamination in student dormitories in Al-Kufa University campus, and to explore the inhibitory effect of three commercially available disinfectants, namely; dettol (chloroxylenol), Al-Emlaq (Alkyl benzene sulphonate), and the house bleach (Sodium hypochlorite).

**MATERIALS AND METHODS**

This study was conducted for the period from October 2022 to Jun 2023. A total of 400 bacteriological swabs were collected aseptically from different sites of male and female student dormitory of Al-Kufa University campus. The site of collection and number of swabs were as follows; bedlinen and bedclothes (n=32), blankets (n= 60), bedchamber walls(n=24), bedchamber furniture (n= 18), lockers(n=32), washbowl (n=16), kitchen floor(n=12), kitchen sink (n= 20), kitchen wall(n=32), food processing table (n=56), refrigerators (n= 24), bathroom wall(n=24), bathroom floor (n= 10), bathroom doors(n=32), washing machines (n= 8). Swabs were streaked as soon as possible on blood agar and MaConkey agar plates and incubated at 37°C overnight. Isolation of bacterial growth was based on subsequent culturing on differential and selective media. Further identification of bacterial species was achieved by colonial morphology and biochemical reactions corresponding to each bacterial species. The inhibitory effect of 40% and 60% concentrations of three commercially available disinfectants; Dettol (chloroxylenol), Al-Emlaq (Alkyl benzene sulfonate),

and the house bleach (sodium hypochlorite) were explored by agar diffusion method. The diameter of the inhibition zone if exceed 10 mm was regarded positive. Data were statistically analyzed.

**RESULTS**

The results revealed that 216(54%) swabs yielded pure bacterial growth (one single bacterial type), 96(24%) swabs yielded mixed bacterial growth (more than one bacterial type), and 88(22%) swabs yielded no growth of bacteria, Table (1).

**Table (1): Types of bacterial growth**

Type of bacterial growth	No.	%
Pure growth	216	54
Mixed growth	96	24
No growth	88	22
Total	400	100

Identification of bacterial growth yielded 428 bacterial species, 246 (57.5%) were recovered from male dormitory units and 182 (42.5%) were recovered from female dormitory units. The overall isolation rate from male dormitory was significantly higher than that from female dormitory (P < 0.05). The isolation rate of *Bacillus* spp. was predominant in both male and female dormitory units (30.9% and 28.6%) respectively, while the least isolation rate was β-hemolytic streptococci (1.2% and 1.1%), respectively. The isolation rates of different bacterial species recovered from male versus female dormitory units are shown in Table (2).

**Table (2): Isolation rates of bacterial isolates from male and female dormitories**

Type of bacteria	Isolation rate		Total (%)
	Male units (%)	Female units (%)	
<i>Bacillus</i> spp.	76(30.9)	52(28.6)	128 (29.9)
Staphylococci (coagulase +)	57(23.2)	26 (14.3)	83 (19.4)
<i>E.coli</i>	43 (19.5)	49 (26.9)	92 (21.5)
<i>Enterococcus faecalis</i>	33 (13.4)	27 (14.8)	60 (14.0)
<i>Proteus</i> spp.	16 (6.5)	19 (10.4)	35 (8.2)
<i>Klebsiella</i> spp.	13 (5.3)	5 (2.7)	18 (4.2)
<i>Pseudomonas</i> spp.	5 (2.0)	2 (1.1)	7 ((1.6)
β-hemolytic streptococci	3 (1.2)	2 (1.1)	5 (1.2)
Total	246 (57.5%)	182 (42.5%)	428 (100%)

One hundred forty-four isolates from different bacteria were employed to test the inhibitory effect of the three disinfectants. These isolates include; β-hemolytic streptococci (5 isolates), *Pseudomonas* spp. (7 isolates), *Klebsiella* spp. (12 isolates), *Proteus* spp. (15 isolates), *Enterococcus faecalis* (20 isolates), *E. coli* (30 isolates),

Staphylococci (25 isolates), and *Bacillus* spp. (30 isolates). Table (3) revealed the inhibition rates of the three disinfectants in a 40% concentration on the bacterial isolates. The overall inhibition rate of Al-Emlaq (46.5%) is significantly higher (p< 0.05) compared to dettol (22.9%) and house bleach (37.5%).

**Table (3): Inhibition rates of disinfectants (40%) on bacterial isolates**

Isolates	Dettol	Al-Emlaq	House bleach
	No. inhibited (%)	No. inhibited (%)	No. inhibited (%)
<i>Bacillus</i> spp. (n=30)	6 (20)	14 (46.7)	9 (30)
Staphylococci spp. (n= 25)	4 (16.0)	9 (36.0)	7 (28.0)

Isolates	Dettol	Al-Emlaq	House bleach
	No. inhibited (%)	No. inhibited (%)	No. inhibited (%)
<i>E.coli</i> (n= 30)	11 (36.7)	15 (50.0)	12 (40.0)
<i>Enterococcus faecalis</i> (n= 20)	6 (30.0)	13 (65.0)	11 (55.0)
<i>Proteus</i> spp. (n=15)	2 (13.3)	6 (40.0)	7 (46.7)
<i>Klebsiella</i> spp. (n= 12)	2 (16.7)	5 (41.7)	5 (41.7)
<i>Pseudomonas</i> spp. (n= 7)	0 (0)	1 (14.3)	0 (0)
$\beta$ -hemolytic streptococci (n=5)	2 (40.0)	4 (80.0)	3 (60.0)
Overall (n= 144)	33 (22.9)	67 (46.5)	54 (37.5)

Regarding the 60% concentration of the disinfectants, the results showed that the overall inhibition rate of Al-Emlaq super gel (61.1%) was

significantly higher ( $p < 0.05$ ) compared to dettol (29.2%) and house bleach (44.4%), table (4).

**Table (4): Inhibition rates of disinfectants (60%) on bacterial isolates**

Isolates	Dettol	Al-Emlaq	House bleach
	No. inhibited (%)	No. inhibited (%)	No. inhibited (%)
<i>Bacillus</i> spp. (n=30)	9 (30)	19 (63.3)	11 (36.7)
Staphylococci (n= 25)	5 (20.0)	11 (44.0)	7 (28.0)
<i>E.coli</i> (n= 30)	13 (43.3)	20 (66.7)	16(53.3)
<i>Enterococcus faecalis</i> (n= 20)	7 (35.0)	13 (65.0)	11 (55.0)
<i>Proteus</i> spp. (n=15)	2 (13.3)	9 (60.0)	8 (53.3)
<i>Klebsiella</i> spp. (n= 12)	3 (25.0)	8 (66.7)	6 (50.0)
<i>Pseudomonas</i> spp. (n= 7)	1 (14.3)	3 (42.8)	2 (28.6)
$\beta$ -hemolytic streptococci (n=5)	2 (40.0)	5 (100)	3 (60.0)
Overall (n= 144)	42 (29.2)	88 (61.1)	64 (44.4)

## DISCUSSION

Bacterial contamination is ubiquitous. Most of our daily domestic customs carry a risk of bacterial infections that most probably originated from household environment, paper currency, and mobile (Olsen *et al.*, 2022; Muloi *et al.*, 2022; Radhi *et al.*, 2023). Moreover, in certain circumstances, these bacterial contaminants are responsible for a serious community acquired or nosocomial infections (Radhi *et al.*, 2023; A and Intisar, 2012). Although the contamination rates in student's dormitories obtained in the present study seems high for the first time. However, these results are not surprising. In a study conducted in Al-Imam Ali Hospital in Baghdad to address bacterial contamination in the surgical theatres, the contamination rate was found to be 3.7% in 2001 and increased to 4.0% in 2002 (Ensayef *et al.*, 2009). Of note, surgical theatres must be always completely sterile.

University dormitories, like other closed communities are exposed to frequent bacterial contamination that may arises from kitchen utensils, food stuffs, washbowls, toilets, bedclothes and inhabitants themselves. It has been found that 26.3% of Iraqi normal healthy population carries the *S. aureus* in their anterior nares and 10% of healthy women carry the microbe in their vagina (Al-Zuhari *et al.*, 2010; Hasan *et al.*, 2008).

Undoubtedly, insufficiently chlorinated or unchlorinated municipal water and dusty weather, which

is common in our country play an important role in increasing and disseminating bacterial contaminants.

As a preventive measure to reduce bacterial contamination, it has been suggested that washing hands with soap or ash after toilet and before eating is a simple and effective way to minimize bacterial contamination and reduce the illness rate among students in university residence hall (Burton *et al.*, 2011). On the other hand, certain routine washing-up of kitchen surfaces or domestic flushing of toilets may spread infection within the household, via direct surface-to-hand-to- mouth contact (Bloomfield *et al.*, 2012).

The inhibitory efficiency of disinfectants on bacterial contaminants depend on the mechanism of action of their active ingredients and the concentration employed (Radhi, 2020). The highest inhibitory effect of alkyl benzene sulfonate (Al-Emlaq super gel) in the present study probably related to its powerful surfactant effects of bacterial contaminants (Lee *et al.*, 2009).

This study documents high rates of bacterial contamination in student's dormitory of Al-Kufa university campus. Official and public awareness toward bacterial contamination in such communities is recommended. Selection of effective disinfectant should be based on its active ingredients and effective concentration.

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