Journal of Health Science 2013, 3(2): 25-28
DOI: 10.5923/j.health.20130302.04

Comparative Assessment of Microbial Contamination from Swabs Collected within University Facilities

Azhar M. Haleem[1,*], Daliah M. Ali Hassan[2], Sedek A. K. Al-Hiyaly[1]

[1]Environmental research center, University of technology
[2]Workshop and training center, University of technology

Abstract The present study which lasted from January to March 2013 aims to evaluate the microbial contamination within the university of technology, Baghdad. 44 swabs were collected from 7 different locations (kindergarten, Building and construction engineering department, workshops and training center, presidency, three cafeterias and restaurants). 56 microbial isolates were obtained, 51 (91.1%) bacteria and 5 (8.9%) fungi, (23.5%)of 51 bacterial isolates belong to Gram positive and 39 (76.55%) for Gram negative bacteria. The total viable count (TVC) was 7.3 log10 CFU/ ml, 3.35 log10 CFU/ ml, 3.45 log10 CFU/ ml, 3.55 log10 CFU/ ml, 5.23 log10 CFU/ ml for kindergarten, Building and construction engineering department, presidency, workshops and training center, three cafeterias and restaurants respectively, while (TVC) of carpets, sinks and bathrooms, lockers, dining table, doorknob was 3.23 log 10 CFU/ ml, 2.25 log10 CFU/ ml, 1.15 log 10 CFU/ ml, 2.15 log10 CFU/ ml, 2.45 log10 CFU/ ml respectively.

Keywords Microbial Contamination, TVC, Swabs and Kindergarten

1. Introduction

Bacteria and fungi spread in all locations and spaces, because their small size and their ability to resist hard conditions beside our inability to see, all of these enable them to survive, multiply and cause serious health problems for many people[1]. Bathrooms and places of food processing (restaurants and cafeterias) play an important role in hygienic aspects which may turn into warehouses of pathogenic microbes[2].

Bacteria represent the most prevalent microbial aggregates, and Gram negative bacteria are the most widespread especially Enterobacteriaceae group which is considered one of fecal contamination indicator and their presence evidence about other pathogen[3, 4].

Gram positive bacteria no less importance in disease incidence for human such as *Staphylococcus, Streptococcus, Bacillus* which are caused serious health problems for human because their Virulence factors[5].

Universities a large places have many facilities such as educational, administrative, services, gardens and others, students and other staff spent more than 8 hours per day, five days a week this long time make them susceptible to different types of disease and injuries and this may lead them to absenteeism and delayed the performance of their duties. This study aims to evaluated the microbial contamination in different locates and sites within university of technology.

95.3% of students and staff eat one meal at least during their presence at the university, 22.4% of staff have one or more children in the kindergarten within the university, 100% of students and staff attending the cafeterias once a week at least.

77.56% of students and staff go to the university health center for health care or for sick leave, 27.5% of sick people suffered from gastrointestinal illness, 63.45 of them suffered from respiratory tract infections 9.05% malnutrition and allergic disease.

2. Materials and Methods

2.1. Sample Collection

The present study which is lasted from January to March 2013 within university of technology Baghdad, Iraq, aimed to evaluate microbial contamination. 44 samples (swabs) were collected from 7 different locations (kindergarten, presidency, Building and Construction Engineering department, workshops and training center and three different restaurant and cafeterias).

Samples with a moisture sterile cotton swab were taken from (kitchens, dining tables, lockers, bathrooms, sinks, refrigerators, freezers, ovens, carpets, children beds and doorknobs), all swabs labeled appropriately and were transported to the laboratory within an hour for culture and treated according to standard method[6,7].

2.2. Total Viable Count

* Corresponding author:
amhjanabi@yahoo.com (Azhar M. Haleem)
Published online at http://journal.sapub.org/health

Total viable plate count (TVC) was enumerated on Plate Count Agar (Biomark Labolatories, India), by incubating at 37°C for 48 hrs. Yeasts and moulds were enumerated using Sabouraud Dextrose Agar (Biomark Labolatories, India) supplemented with chloramphinecol (100µg/ml) after incubating at 28°C for 72 hrs. *Escherichia coli*, Enterobacteriaceae and coliform were grown on McCongy agar plates *E coli* diagnosed on EMB agar (Biomark Labolatories, India).

Staphylococcus was determined using manittol salt agar (Biomark Labolatories, India) after incubation at 37°C for 48 hrs. All plates were examined visually for typical colony types and morphological characteristics associated with each growth medium. Suspected colonies were tested biochemically by the methods as described in the Food and Drug Administration Bacteriological Analytical Manual)[8].

2.3. Statistical Analyses

Descriptive statistical analysis (frequency, percentage) were employed using SPSS version 16, one ANOVA was used for multiple comparisons and statistical difference considered significant at $P \leq 0.05$.

3. Results and Discussions

From table figure 1 and 2, 44 swabs were collected gave 56 microbial isolates, 51 (91.1%) bacteria and 5 (8.9%) fungi, 39 (76.5%) Gram negative bacteria and 12 (23.5%) Gram positive bacteria. Enterobacteriaceae group was most prevalent than other bacteria, four isolates of *Candida albicans* and one dermatophytes *Trycophyton sp.* was isolated through this study (fig 1, 2).

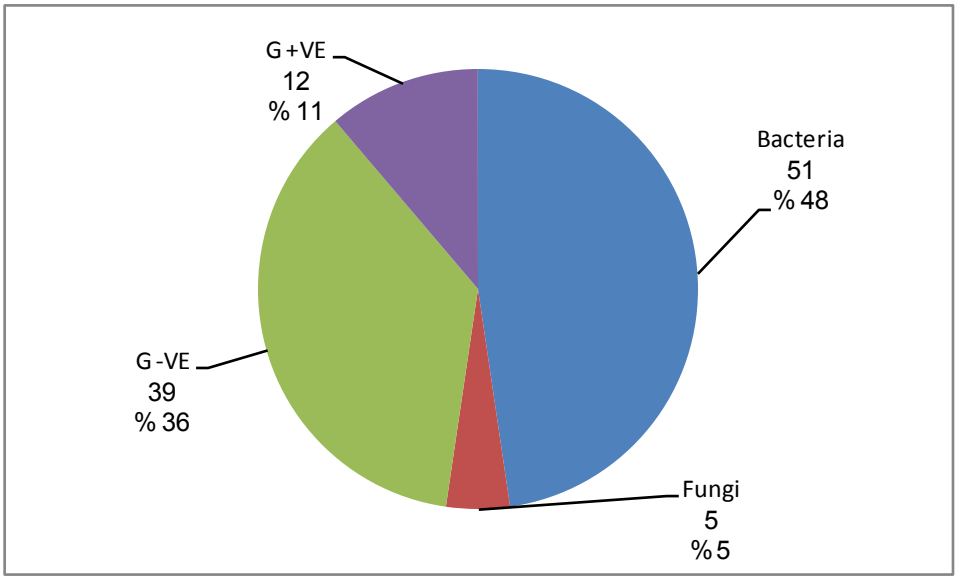

Figure 1. Distribution of microbial group frequency

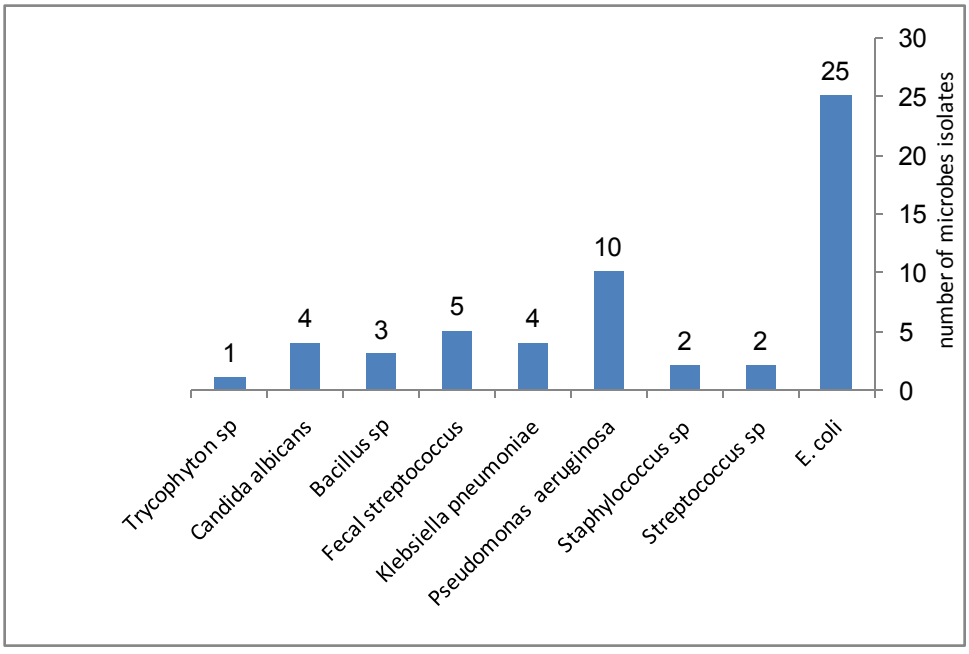

Figure 2. Distribution of microbial species frequency

3.1. Total Viable Count

Table 1. Mean distribution of bacteria and fungi according to locations and sites

Type of microorganisms /viable count (Log_{10} CFU)/ml	Locations				
	kindergarten	Building and construction dept.	Presidency	Workshop and training center	Cafeterias and restaurants
Total viable count	7.3±0.11a	3.35±0.21a	3.45±0.24a	3.55±0.16a	5.23±0.05a
E. coli	2.2±0.11b	1.2±0.19b	2.42±0.05b	1.1±0.01b	1.15±0.11b
Streptococcus sp.	1.5±0.24c	0.0	0.0	0.0	1.2±0.12b
Staphylococcus sp.	1.4±0.14c	0.0	0.0	0.0	2.1±0.25c
Pseudomonas aeruginosa	2.11±0.26b	2.5±0.21c	2.3±0.15b	1.84±0.61c	2.5±0.15c
Klebsiella pneumoniae	3.26±0.23d	2.15±0.14c	1.4±0.092c	2.78±0.24d	2.2±0.17c
Fecal streptococcus	3.1±0.12d	0.0	1.2±0.01c	1.2±0.5b	2.1±0.11c
Bacillus sp.	1.1±0.12c	0.0	0.0	1.2±0.34b	0.0
Candida albicans	1.23±0.11c	1.56±0.12b	1.23±0.01c	0.0	2.2±0.12c
Trycophyton sp.	posetive	Negative	Negative	Negative	Negative
Type of microorganisms / viable count (Log_{10} CFU)/ml	Sites				
	Carpets	Sinks and bathrooms	Lockers	Dining table	Doorknob
Total viable count	3.23 ±0.12a	2.25±0.21a	1.15±0.14a	2.15±0.16a	2.45±0.11a
E. coli	1.89±0.31b	2.2±0.24b	1.56±0.11b	1.1±0.15b	1.23±0.32b
Streptococcus sp.	1.5±0.24c	1.2±0.12b	0.0	0.0	0.0
Staphylococcus sp.	0.0	1.4±0.14c	0.0	0.0	2.1±0.25c
Pseudomonas aeruginosa	2.02±0.3b	3.12±0.14c	1.3±0.17b	1.14±0.01c	2.87±0.12c
Klebsiella pneumoniae	1.16±0.11a	3.17±0.14c	1.54±0.02c	1.68±0.13d	1.2±0.21c
Fecal streptococcus	2.1±0.12d	3.4±0.22	1.3±0.11c	0.98 ±0.01 b	2.1±0.18c
Bacillus sp.	1.1±0.12c	0.0	1.2±0.34b	0.0	0.0
Candida albicans	0.75±0.15c	1.65±0.15b	0.99 ±0.01	0.0	2.2±0.12
Trycophyton sp.	positive	Negative	Negative	Negative	Negative

Each number refer Mean ±Standard deviation of three replicate
Different letters in the same column refer to significantly differences at ($p<0.05$)

The mean microbial population of the samples analyzed is presented in table 1, kindergarten gave higher (TVC) among other sites 7.3 Log10 CFU/ml followed by cafeterias and restaurant in (TVC) 5.23 Log10 CFU/ml, while engineering of Building and construction dept. came finally with (TVC) 3.35 Log10 CFU/ml.

E. coli, *Pseudomonas aeruginosa*, *Klebsiella pneumonia* and *fecal streptococcus* gave higher enumerations among other bacterial especially in kindergarten and cafeterias this may return it to large number of children (140) who share the same bathrooms in addition to lack of proper health behaviors that limit the spread of microbes in the whereabouts[9], the presence of dermatophytes *Trichophyton sp* in the kindergarten may be the children under school age are susceptible to these fungi more than others because lack of sebum production, which are a natural contrary to growth and spread of these fungi, in addition to these spore forming fungi resist the treatment with detergents and antiseptic[10, 11]. The cafeterias came in the second level in the microbial contamination this may be due to all people who work in it have intermediate educational level beside their dealing with raw materials (vegetables, fruits, meats and others) which have high content of microbes, the presence of *E. coli* and other Enterobacteriaceae is an indication of possible fecal contamination of food, water or food workers and poor hygienic processing practices[12, 13] The presence of *S. aureus* is largely as a result of human contact and this suggests poor hygiene practices of the operators since this organism is a normal flora of the skin and nasal passage[14, 15]. Other locations like Workshop and training center, Presidency and Building and construction dept. have high microbial contamination due to lack of bathrooms cleaning regularly and unused effective detergents and antiseptic, beside an appropriate process of cleaning by using one rag to clean more than one site for example tables, doors, windows etc. this rag will become a source of contamination and speared the microbes.

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