CSIR-FRI/RE/2015/019

CSIR-Food Research Institute

MICROBIOLOGICAL SAFETY OF THE WASHROOMS IN THE MAIN BUILDING OF CSIR-FOOD RESEARCH INSTITUTE

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October, 2015

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ABSTRACT

Public washrooms are contaminated with different kinds of bacterial from human secretions ranging from saliva, skin, urine, fecal matter etc. Unfortunately their usage is unavoidable as long as one is outside the home. The aim of this study therefore was to determine the level of bacterial contamination of the washrooms in CSIR–Food Research Institute and their microbiological safety. Swabs of surfaces at the washrooms sited in the main building of CSIR - Food Research Institute were collected with sterile swab sticks moistened with Salt Peptone Solution (SPS). The swab samples were analyzed for total aerobic mesophiles, coliforms, *E.coli*, *Enterococcus* spp, *Staphylococcus aureus* and *Salmonella typhi.* The washrooms at the directorate recorded the lowest microbial counts of aerobic mesophiles from this study with no counts of any pathogen on all surfaces swabbed followed by the male and female washrooms on the second floor. The other floors recorded different levels of aerobic mesophiles as well as pathogens such as *E.coli*, *Enterococcus* spp, *Staphylococcus aureus*. Quality soap, detergents and disinfectants should be provided for the cleaning of these washrooms every time and users of the washrooms should see thorough hand washing as the first line of defense in preventing the spread of diseases associated with these bacterial and pathogens found in the washroom. Soap for hand washing therefore ought to be provided by CSIR-Food Research Institute always.

INTRODUCTION

A public toilet (also called a bathroom, restroom, latrine, comfort room, powder room, toilet room, washroom, water closet, W.C., public lavatory, lav, convenience, loo) is a room or small building containing one or more toilets and possibly also urinals which is available for use by the general public, or in a broader meaning of "public", by customers of other services. Public toilets are commonly separated by sex into male and female facilities, although some can be unisex, particularly the smaller or single occupancy types (Anon, 2015). Public washrooms are unavoidable as long as one is outside the home and are in constant use throughout the day. Public washrooms have large traffic of users who throng in with their own microbial flora and other organisms they have picked elsewhere and deposit them on door handles while going into the place of convenience and on their way out (Goldhammer *et al.,* 2006). These washrooms are therefore contaminated with microbes from human secretions ranging from saliva, skin, urine, fecal matter etc (Scott and Barlow, 1982).

The door handles of toilets remains one of the most implicated probable sources of infections (Reynolds, K., 2005). Bacteria seeded into toilets remain in the toilet for a long time after multiple flushing and cleaning with antimicrobial fluids (Barker and Jones, 2005). Other surfaces such as sinks, flush handles, soap dispensers; floors etc may also be sources of contamination from the washrooms. Illnesses that results from the usage of such public washrooms include diarrhea, Urinary Tract Infections (UTI), Venereal disease and Severe Acute Respiratory Syndrome (SARS), food borne illness etc (Kramer *et al.,* 2006).

Bacteria from public washrooms are of public health importance as they can enter the body via hand to mouth contact or hand to food contact. The scenarios depicted for public washrooms may not be too different from what pertains in CSIR – Food Research Institute. Although the

washrooms in this facility are daily cleaned to prevent infections, studies have shown that washroom surfaces cannot be totally free from microorganisms. The aim of this study was to determine the level of bacterial contamination of the washrooms in CSIR – Food Research Institute and their microbiological safety.

MATERIALS AND METHODS

Sample collection:

Swabs of surfaces at the washrooms sited in the main building of CSIR - Food Research Institute were collected with sterile swab sticks moistened with Salt Peptone Solution (SPS). An approximate area of 20 cm^2 was swabbed for each selected site. Each site was swabbed without overlapping a previously swabbed area. A total of 31 swab samples were covered. The washrooms were divided into four sections: visitor's washroom at the basement, ground floor (GF), first floor (FF), second floor (SF) and directorate. Female and male washrooms were examined separately. Surface areas sampled included; tap handles, toilet flush handles, door handles, soap dispensers and sinks.

Microbial analyses:

The swab samples were analyzed for aerobic mesophilic count, coliform, *E.coli*, *Enterococcus* spp, *Staphylococcus aureus* and *Salmonella typhi*. The swabs were serially diluted and aerobic mesophiles were enumerated by pour plate on Plate Count Agar (Oxoid CM325; Oxoid Ltd., Basingstoke, Hampshire, UK), incubated at 30 °C for 72 h in accordance with NMKL No. 86, 2006. Total coliforms and *E. coli* were enumerated by pour plate on Tryptone Soy Agar (Oxoid CM131), pH 7.3 overlaid with Violet Red Bile Agar (Oxoid CM107), pH 7.4 and incubated at 37 °C for 24 h for total coliforms and at 44 °C for 24 h for *E. coli*. Colonies for total coliforms were confirmed on Brilliant Green Bile Broth (Oxoid CM31), pH 7.4 incubated at 37 °C for 24 h according to NMKL No. 44 (2004) and *E. coli* using EC Broth (Oxoid CM853), pH 6.9, followed by Trypton Water (Oxoid CM87), pH 7.5, all incubated at 44 °C for 24 h as described by (NMKL. No. 125, 2005). *Enterococcus* was dertermined according to NMKL No 68,5th Ed.

2011.*Staphylococcus aureus* was determined by the spread plate method using Baird-Parker Agar (BP, CM 275 Oxoid Ltd, Hampshire, England.) supplemented with Egg Yolk Tellurite Emulsion (SR54) and Blood Agar Base (BAB, CM 55 Oxoid Ltd, Hampshire, England.). Both media were incubated at 37 ^{o}C for 48 h according to NMKL Method No. 66, 4th Ed., 2003 whilst Salmonellae was determined according to NMKL Method No. 71, 1999.

RESULTS

The results obtained from the analyses showed that generally, the population of aerobic mesophiles on the taps on all the floors in the building ranged from 10^2-10^5CFU/ml (Fig 1). Coliform and *E.coli* were in the range of 10-10^2CFU/ml for the taps on both the ground and first floors with the exception of the visitors washroom at the basement, the second floor and the directorate.

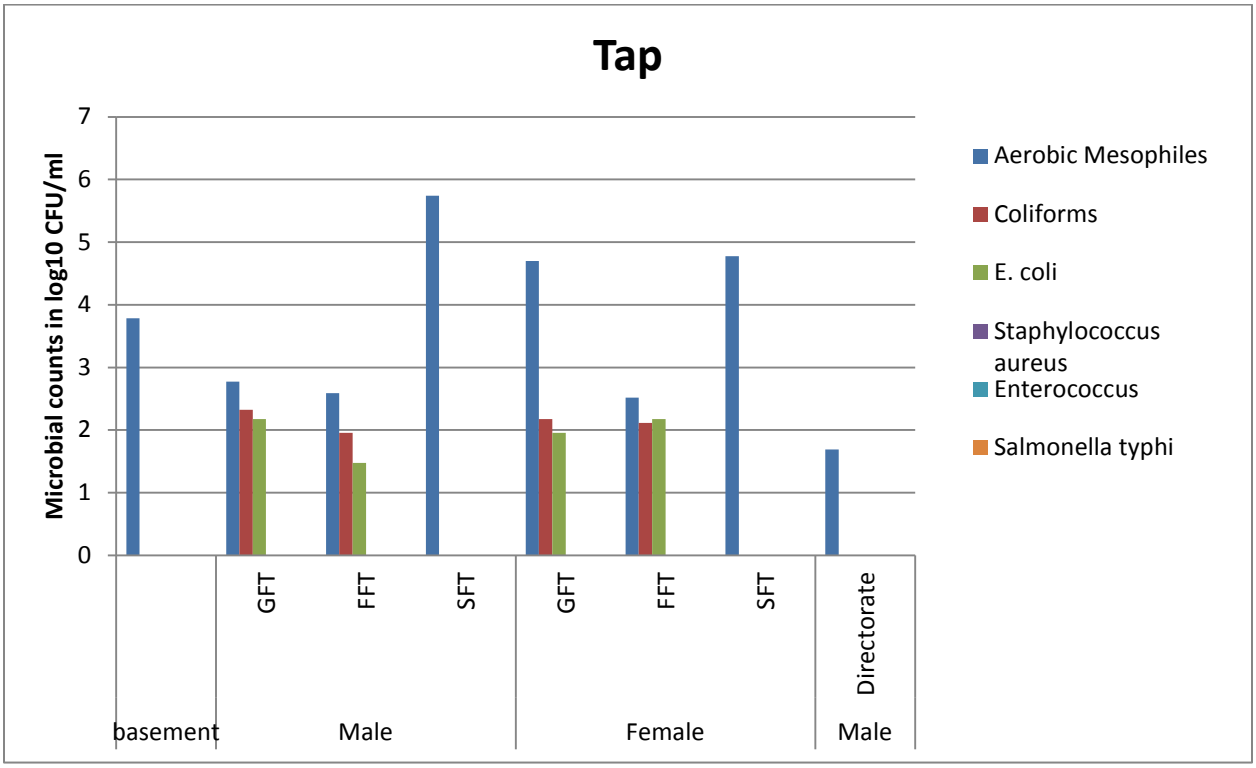

Fig 1: Microbial counts on taps from the various washrooms

The flush handles on the ground floor recorded the highest aerobic mesophiles of 10^4 CFU/ml for both male and female washrooms (Fig 2). The population of coliforms and *E.coli* ranged from 10^1-10^2 CFU/ml for both male and female washrooms. A population of 10^2 CFU/ml for *Staphylococcus aureus* was also enumerated from the visitor's washroom at the basement and

the female washroom on the ground floor whilst no pathogen was recorded from the second floor and the directorate.

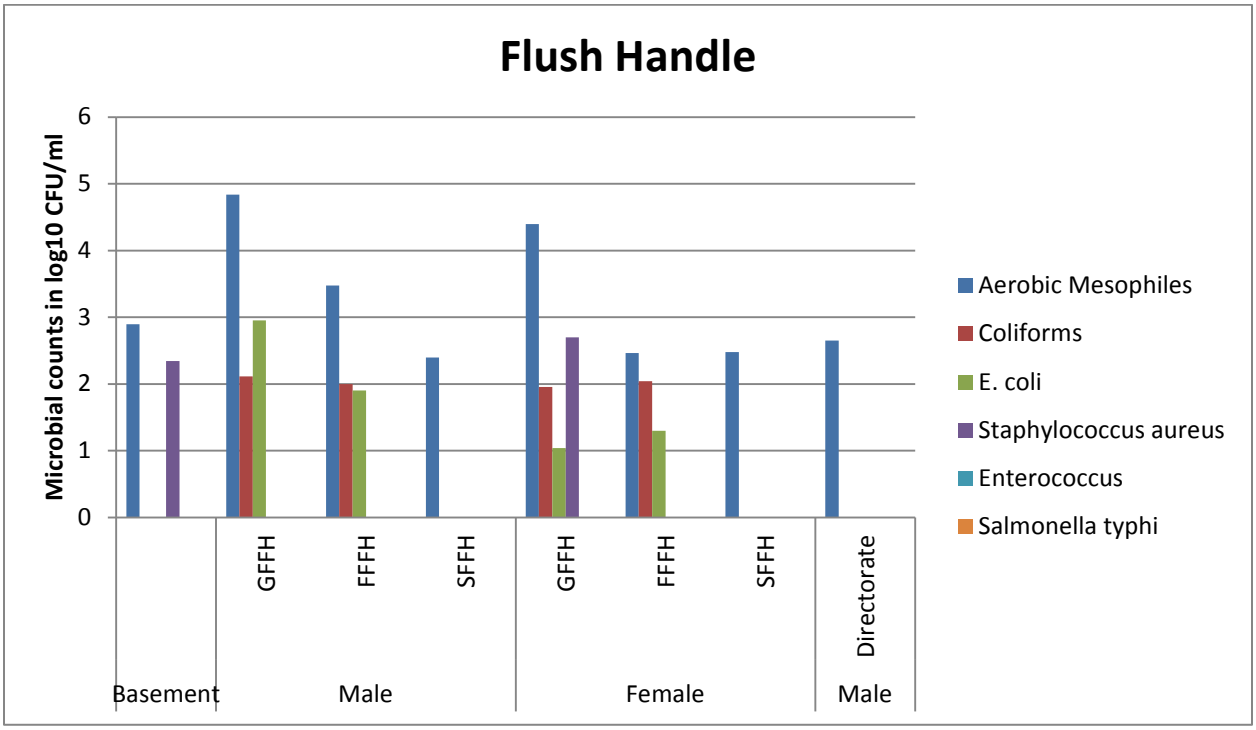

Fig 2: Microbial counts on flush handles from the various washrooms

The highest population of aerobic mesophilic counts of 10^5 CFU/ml was recorded from the surfaces of the soap dispenser from the female washroom at the second floor. However, a lower population of 10 CFU/ml *Staphylococcus aureus* was enumerated on the soap dispenser situated in the male and female washroom on the first floor (Fig 3).

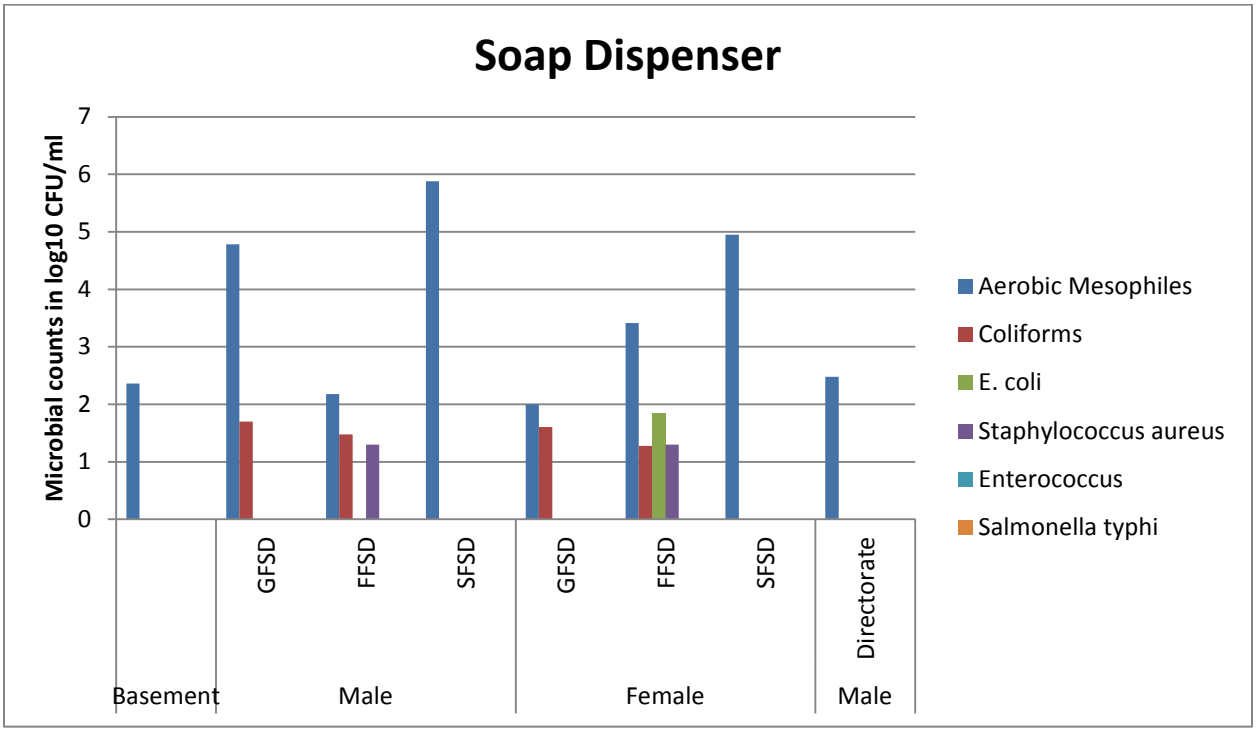

Fig 3: Microbial counts on soap dispenser from the various washrooms

A population of 10^2 CFU/ml was recorded for *Staphylococcus aureus*, coliform and *E.coli* from the sinks in both male and female washrooms on the first floor (Fig 4). Aerobic mesophiles were in the range of 10^3-10^4 CFU/ml across all washrooms. The visitor's washroom at the basement also recorded counts of 10^3 CFU/ml of *Enterococcus* spp which was absent on all other surfaces swabbed from all the washrooms.

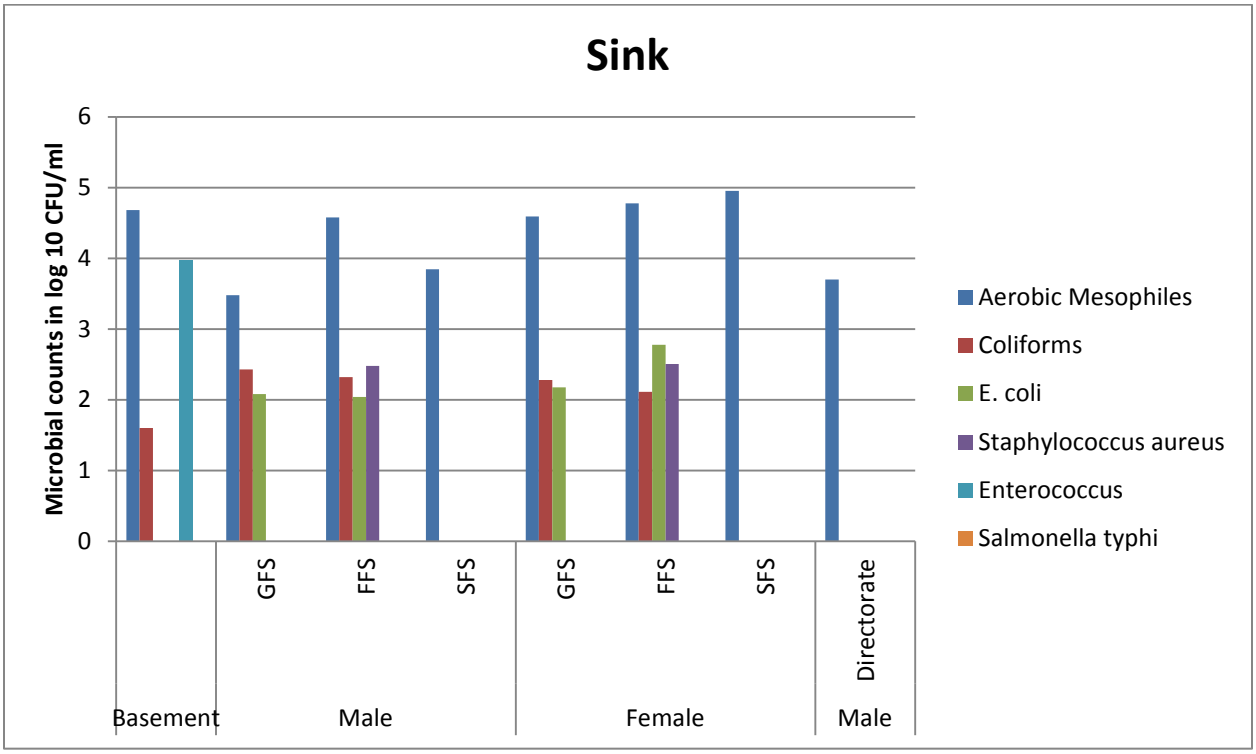

Fig 4: Microbial counts on sinks from the various washrooms

Staphylococcus aureus was again recorded from swabs on the doors to the visitors washrooms at the basement and the male washroom on the ground floor (Fig 5).The doors of the male and female washrooms on the ground floor and male washroom of the first floor also had populations of *E.coli* (10^2 CFU/ml).

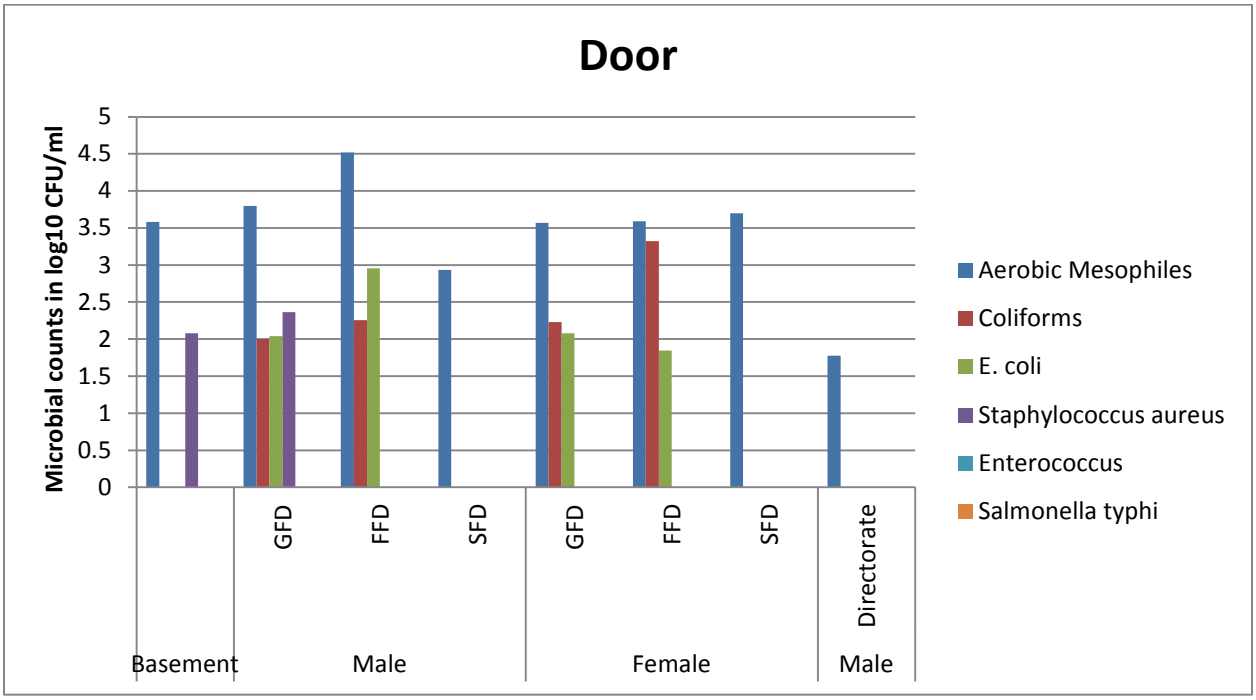

Fig 5: Microbial counts on doors from the various washrooms

In general, all the surfaces swabbed recorded different levels of aerobic mesophils whilst *E.coli* was detected on 42.5% of these surfaces as shown in table 1. *Salmonella typhi* was not detected on any of the surfaces.

Table 1: Percentages of the different bacterial detected from the surfaces swabbed.

Type of Bacterial	**Percentage (%) of Bacterial on all the Surfaces Swabbed**
Aerobic Mesophiles	100
E.coli	42.5
Coliform	50
Staphylococcus aureus	22.5
***Enterococcus* spp**	2.5
Salmonella typhi	0

DISCUSSION

The results showed that generally, the various surfaces in the washrooms were all contaminated with one bacterial or the other at varying levels. *E.coli* was recorded on almost all the surfaces swabbed from both the male and female washrooms on the ground and first floors. This result was expected as surfaces in washrooms have generally been described as being hot spots of bacterial contamination. This is due to the fact that several pathogenic bacteria are known to survive on these surfaces for extended periods of time (Barker and Bloomfield, 2000; Dancer and Robertson, 2007). The male and female washrooms on the second floor although recorded high populations of aerobic mesophiles had no population of pathogens. Similarly, the washrooms at the directorate only recorded low population of aerobic mesophiles. These outcomes may be attributed to the number of people who use the various washrooms, frequency of usage by its occupants/visitors as well as the frequency and effectiveness of the cleaning and disinfecting process. The presence of species of *Staphylococcus aureus* isolated from surfaces such as the sinks, soup dispensers, doors and flush handle was expected as they are resident flora of the human skin and thus easily contaminate surfaces on contact (Goldhammer *et.al.*, 2006).

Every time the toilet is flushed with an open lid, bacteria are spray into the air and some of these bacteria could pass along symptoms of diarrhea or vomiting. A study conducted by Scientists at Leeds University tested the air above toilets and found that the bacteria, C. *difficile*, which causes vomiting, can be spewed up to 10 inches above the toilet seats with every open flush. These bacteria were found on the sides, on the top of the toilet, and on the floor—even when the toilet wasn't in use. Although the highest levels of bacteria were found right after a flush, even 90

minutes later, between 15-47 contaminated water droplets were detected on nearby surfaces. The best way therefore to prevent the spread of these bacteria is to keep the lid closed which reduced

the spread of bacteria by 10 times (Anon., 2015). This is an indication that contamination of the surfaces in the CSIR-Food Research Institute beside the human contact may be due to the air-borne dissemination of microbes as the toilet lids are always opened during flushing.

Regular and efficient cleaning is therefore necessary to control the number of microbes as most microbes can be removed from surfaces, just by the simple act of mechanical cleaning (ICGPS, 2006). However, because of the nature of activities that takes place in these washrooms, detergents and disinfectants are very much needed for any effective cleaning. Detergents are effective in cleaning the surfaces they come in contact with, and help in reducing the total microbial load (Holah, 2003). Disinfection will further remove or kill germs, but it does not kill all living matter, so does not make items sterile. Any item that is to be disinfected must first be thoroughly cleaned, as most disinfectants are quickly inactivated by dirt (ICGPS, 2006). Surfaces such as toilet handles, seats, door handles, taps, sinks and others should be disinfected at least twice daily and also if visibly soiled. Cleaning and disinfecting of all these surfaces in the washrooms is therefore very important in guaranteeing the microbial safety of the washrooms and should therefore be accurately done to ensure its effectiveness in reducing the microbial populations on these surfaces and hence the spread of diseases. It is therefore important for the Institute to provide these necessities at all times for the cleaning of the washrooms to reduce the spread of pathogens especially *E.coli* whose native habitat is the enteric tract of man.

Users of the washrooms should see hand washing thoroughly as the first line of defense in preventing the spread of diseases associated with this and the other pathogens. Unfortunately,

many people seem to run water over their hands without using soap even when its available and some fail to wash their hands at all after using the washroom.

CONCLUSION

Moderate levels of bacterial contamination were recorded from the various washrooms in CSIR-Food Research Institute. Although few of the washrooms can be regarded as safe, most of them are the reverse due to the presence of the pathogens *E.coli*, *Enterococcus* spp and *Staphylococcus aureus* as expected. Even though the washrooms are cleaned twice a day, special attention during cleaning should be given to those areas and surfaces where the greatest number of bacterial was isolated to reduce the probability of disease transmission. Despite the fact that the washrooms cannot be free from microorganisms, good and proper personal hygiene practices should be ensured and put into practice by all users to minimize cross contamination and prevent spread of diseases and infections. In this regard, soap for hand washing should always be provided by CSIR-Food Research Institute. In addition, quality detergents and disinfectants should also be provided for the cleaning of the washrooms.

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