

MICROBIAL CONTAMINATION OF LAPTOPS' KEYBOARDS AND THE EFFICACY OF HOME DISINFECTANTS

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Abstract: In the technology century, almost everyone has to use computers. The computer itself might be contaminated by microbes that can be transmitted and affect the users. Identification of these microorganisms and then eliminate them is necessary to ensure safe use of computers.

Objective: To determine the degree of microbial contamination on the laptops' keyboards, to determine the efficacy of different home disinfectants.

Materials & Methods: 30 specimens (laptops) were collected from 15 male and 15 female students in Collage of Medicine at King Faisal University at ALAhsa. Laptops' keyboards were swabbed by sterile technique, and were cultured on blood agar, nutrient agar, mannitol salt agar using the spread plate technique to detect bacterial count (colony forming unit CFU). The specimens were incubated at 37 °C for 48 hours. 3 different home disinfectant:

1- drinking water 2- 5%chlorine (the Clorox company) with water 3- 5% detol with water were prepared. Each laptop were divided into 3 regions in each region only one disinfectant were applied. After drying, we swabbed the 3 regions and the swabs materials were cultured again.

Results: Bacteria was detected in a significant number on laptops. We detected in female laptops a higher CFU than male laptops. All disinfectants were highly effective in removing or inactivating bacteria. Drinking water was as effective at removing the pathogens as others. None of the disinfectants has any visible effects on the appearance of the letters on laptops' keyboards.

Conclusion: The use of laptops' keyboard s may pose the risk of microbial contamination to users. Simple home based disinfectant can eliminate the contaminated pathogen, and their use is highly recommended.

Keywords: microbial, contamination, keyboards, disinfectants.

1. INTRODUCTION

In the technology century, almost everyone has to use computers. The computer itself might be contaminated by microbes that can be transmitted and affect the users. Identification of these microorganisms and then elimination them is necessary to ensure safe use of computers.

2. MATERIALS & METHODS

30 specimens (laptops) were randomly collected from 15 male and 15 female students in the Collage of Medicine at King Faisal University at Al-Ahsa. Each laptop was divided into 3 almost equal parts (fig. 1). A sterile, cotton tipped swab moistened with sterile physiological saline was used to swab each part. Each button was wiped separately to ensure that we wiped the entire keyboard surface. The swab was placed in a tube containing 1ml of physiological saline. The tube was vortexed for 15 seconds in Fisher Vortex Genie. 20µl of the specimen was plated on Muller Hinton agar by the spread plate technique. The plates were incubated at 37°C for 24 hours. Colonies were then counted to identify the number of colony forming units (CFU) on each part.

Three home cleaning solutions were prepared and used for cleaning the 3 parts of keyboard; 1- Bottled drinking mineral water 2- 5% chlorine (Clorox company) in water 3- 5% Detol in water. Part I was cleaned with water, Part II was cleaned with chlorine and Part III was cleaned with Detol. Sterile gauze sponges (5x5 cm) were folded, wet with the cleaning solution, squeezed and used in cleaning. The keyboard was left for 15 minutes to dry. After drying, each part was re-swabbed, inoculated and incubated following the previous technique. The CFU were counted thereafter.

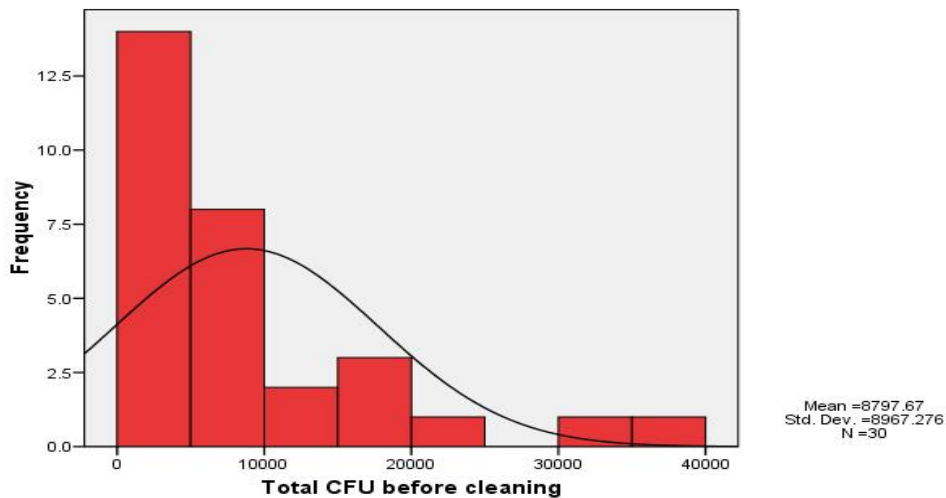
Analysis: Data were fed into the computer and analysed by SPSS for windows version 15. Descriptive statistics were calculated (mean ± standard deviation (SD), median and inter-quartile range). The No. of CFU was compared between the

3 parts before cleaning and between males and females. It was compared on each part before and after cleaning. Nonparametric tests of significance were used because of the skewed distribution of CFU. The level of significance was $p < 0.05$.

3. RESULTS

Initial CFU on Laptop keyboards (descriptives)					
		CFU on part I before cleaning	CFU on part 2 before cleaning	CFU on part 3 before cleaning	Total CFU before cleaning
N	Valid	30	30	30	30
Mean		3440.33	2133.33	3224.00	8797.67
Median		1450.00	1575.00	1600.00	5850.00
Std. Deviation		5126.258	1776.543	5231.771	8967.276
Minimum		150	300	100	700
Maximum		21040	7400	26520	36000
Percentiles	25	750.00	787.50	950.00	3050.00
	50	1450.00	1575.00	1600.00	5850.00
	75	3125.00	3537.50	2725.00	11675.00

Total CFU before cleaning

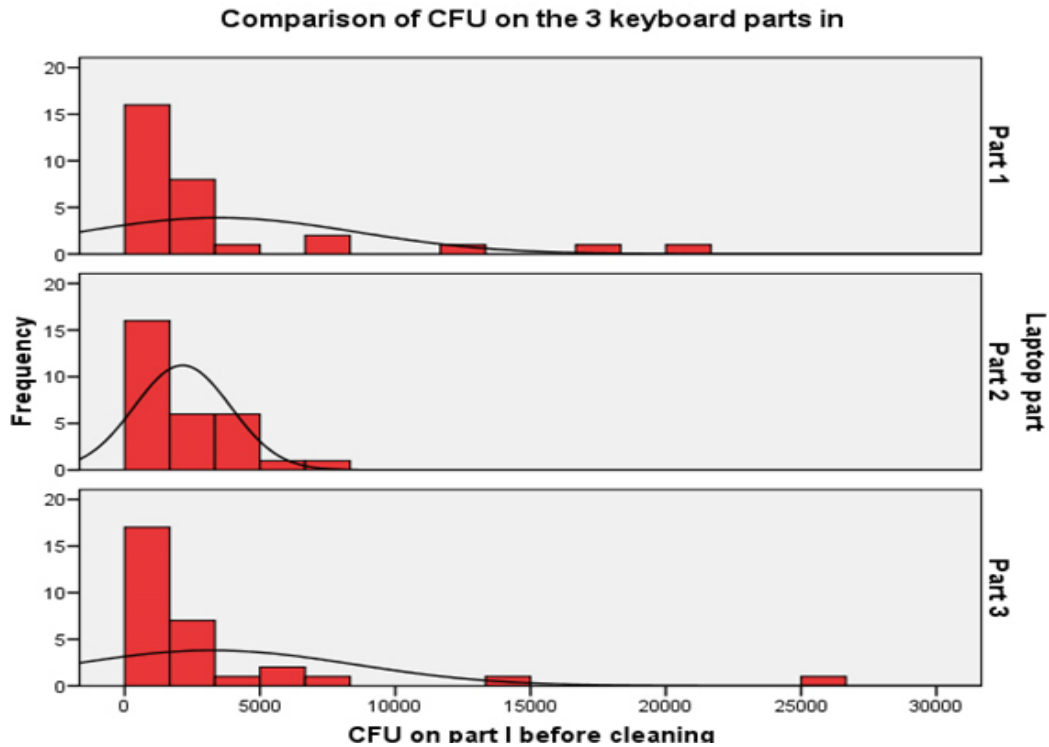


NPar Tests

Kruskal-Wallis Test

Test Statistics(a,b)	
	CFU on part I before cleaning
Chi-Square	.092
df	2
Asymp. Sig.	.955
a Kruskal Wallis Test	
b Grouping Variable: Laptop part	

No significant difference in CFU on the 3 parts of Keyboards



Conclusion:

- ✚ All 3 parts of Laptop keyboards show considerable contamination by CF organisms
- ✚ Median CFU are 1450 (IQR= 750-3125), 1575 (IQR= 788-3538) and 1600 (IQR= 950-2725) on the 3 parts respectively
- ✚ The CFU on the 3 parts are not significantly different from each other
- ✚ Median total CFU on the keyboard is 5850 (IQR= 3050-11675)

Total CFU before cleaning in female and male Keyboards

Descriptives				
	Sex		Statistic	Std. Error
Total CFU before cleaning	Female	Mean	10722.00	2837.741
		Median	6600.00	
		Std. Deviation	10990.525	
		Minimum	2150	
		Maximum	36000	
		Range	33850	
		Interquartile Range	12760	
	Male	Mean	6873.33	1588.312
		Median	4300.00	
		Std. Deviation	6151.506	
		Minimum	700	
		Maximum	19500	
		Range	18800	
		Interquartile Range	9250	

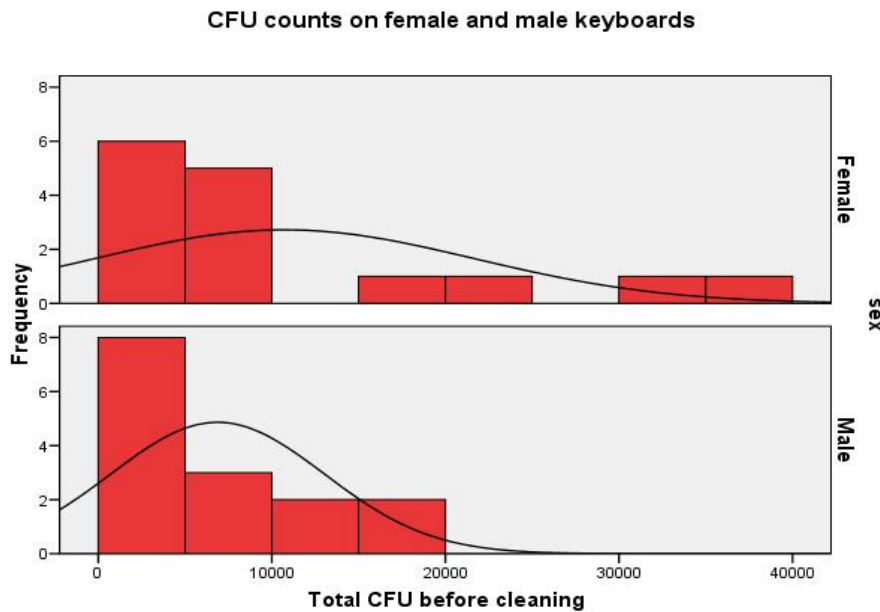
Female Keyboards have higher median and wider interquartile range of CFU than males

NPar Tests

Mann-Whitney Test

Test Statistics(b)	
	Total CFU before cleaning
Mann-Whitney U	85.000
Wilcoxon W	205.000
Z	-1.141
Asymp. Sig. (2-tailed)	.254
Exact Sig. [2*(1-tailed Sig.)]	.267(a)
b Grouping Variable: sex	

The difference in CFU on female and male Keyboards is not significant



Conclusion:

- ✚ Female laptop keyboards have higher total CFU counts than males
- ✚ The difference in contamination potential is not statistically significant

CFU on Laptop keyboards after cleaning (descriptives)								
	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
CFU on part 1 after cleaning	30	259.67	265.544	0	1200	50.00	200.00	352.50
CFU on part 2 after cleaning	30	102.67	173.998	0	800	.00	25.00	127.50
CFU on part 3 after cleaning	30	175.33	256.216	0	1360	50.00	100.00	212.50
Total CFU after cleaning	30	537.67	582.365	50	2960	187.50	420.00	600.00

Wilcoxon Signed Ranks Test

Comparing CFU on keyboards before and after cleaning

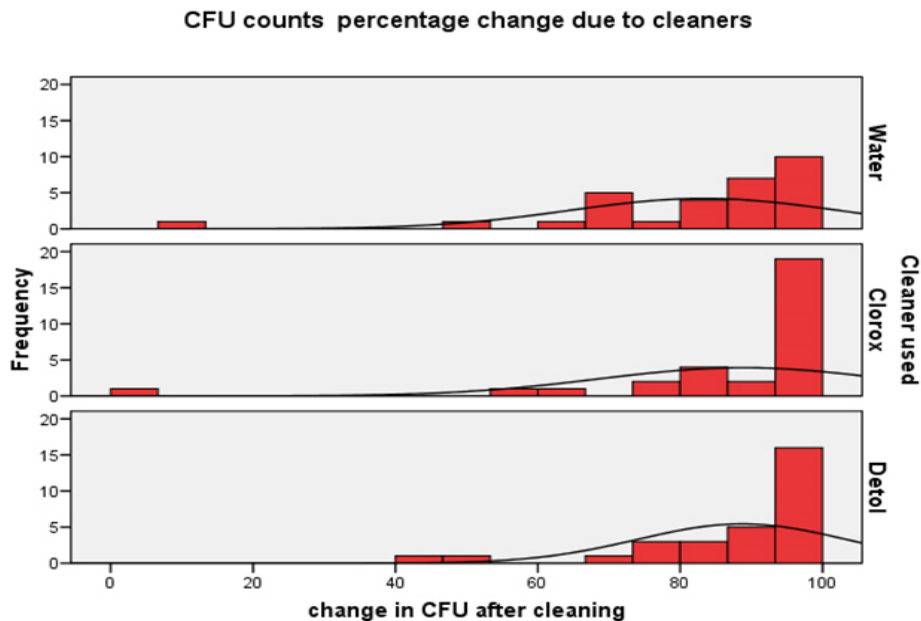
Test Statistics(b)				
	CFU on part 1 after cleaning - CFU on part 1 before cleaning	CFU on part 2 after cleaning - CFU on part 2 before cleaning	CFU on part 3 after cleaning - CFU on part 3 before cleaning	Total CFU after cleaning - Total CFU before cleaning
Z	-4.783(a)	-4.704(a)	-4.783(a)	-4.782(a)
Asymp. Sig. (2-tailed)	.000	.000	.000	.000
a Based on positive ranks.				
b Wilcoxon Signed Ranks Test				

CFU on the Keyboards are significantly less after cleaning by water, Clorox and Detol.

Percent decline in CFU after cleaning (Statistics)*				
		% decline with water	% decline with Clorox	% decline with Detol
N	Valid	30	30	30
Mean		83.3202	88.8570	88.6487
Median		88.1250	98.1707	94.7692
Std. Deviation		18.96286	20.33538	14.66171
Minimum		9.09	.00	40.00
Maximum		100.00	100.00	100.00
Percentiles	25	73.0556	82.5000	81.4236
	50	88.1250	98.1707	94.7692
	75	95.0317	100.0000	97.9043

* [(initial count – final count)/initial count * 100]

Percent decline in CFU after cleaning with water, Clorox and Detol



Mann-Whitney Test

Comparing water and Clorox effect on % decrease in CFU

Test Statistics(a)	
	change in CFU after cleaning
Mann-Whitney U	285.500
Wilcoxon W	750.500
Z	-2.466
Asymp. Sig. (2-tailed)	.014
a Grouping Variable: Cleaner used: water versus Clorox	

Clorox is significantly more effective in decreasing CFU than water

Mann-Whitney Test

Comparing water and Detol effect on % decrease in CFU

Test Statistics(a)	
	change in CFU after cleaning
Mann-Whitney U	348.000
Wilcoxon W	813.000
Z	-1.509
Asymp. Sig. (2-tailed)	.131
a Grouping Variable: Cleaner used: water versus Detol	

Detol is not significantly different in decreasing CFU than water

Mann-Whitney Test

Comparing Clorox and Detol effect on % decrease in CFU

Test Statistics(a)	
	change in CFU after cleaning
Mann-Whitney U	353.500
Wilcoxon W	818.500
Z	-1.450
Asymp. Sig. (2-tailed)	.147
a Grouping Variable: Cleaner used: Clorox versus Detol	

Clorox is not significantly different in decreasing CFU than Detol

Conclusion:

- ✚ The 3 cleaners resulted in marked % decline [(initial count – final count)/initial count * 100] in the number of CFU on keyboards.
- ✚ The median (IQR) % decline for the 3 parts is 73% (88%-95%), 83% (98%-100%) and 81% (95%-98%) respectively.
- ✚ Water is as effective as Detol in decreasing the CFU on keyboards
- ✚ Detol is as effective as Clorox in decreasing the CFU on keyboards
- ✚ Clorox is significantly more effective than water but not than Detol

4. RECOMMENDATIONS

- Periodic cleaning of keyboards is necessary.
- Wiping them with Clorox or Detol is ideal but water is also effective.

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