Bacterial Contamination of Kitchen Sponges and Cutting Surfaces and Disinfection Procedures

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Abstract

Background: The most common of bacterium in kitchen sponges and cutting surfaces which can play a task within the cross-contamination of foods, fomites and hands by foodborne pathogens.

Aims and Objectives: This study investigated the incidence of bacterium in kitchen Sponge, and cutting surfaces.

Material and Methods: a complete of twenty four kitchen Sponges were collected from home kitchens and therefore the numbers of mesotrophic microorganism, coliform microorganism, E. coli, Salmonella, genus {pseudomonas|bacteria genus} and staphylococci in every kitchen Sponges were determined. Microbiological tests of all sponges for total mesophilic aerobic microorganism, S. aureus, Pseudomonas, Salmonella spp., and E. coli were performed on days 3, 7, and 14 by sampling. The sponges involved in daily use in kitchens countenosely with the dishwasher detergent a minimum of doubly daily

Results: Results from the overall mesophilic aerobic microorganism, indicate a major increase within the variety of log CFU/ml. the amount of E. coli was reduced, Salmonella spp. was stabled, S. aureus was enhanced from the sponges throughout fourteen days. Genus Pseudomonas was enhanced and was the dominant micro flora within the sponges throughout fourteen days.

The sponges had MPN of 9.9 log CFU/ sponge, among the analyzed sponges, 8.2, 6.5, and 5.5 log CFU/ sponge wherever found to E. coli, Salmonella and S. aureus severally.

The boiling technique was the foremost effective in inactivating microorganisms and able to cut back the overall counts by 9.9 – 4.7 log CFU/sponge (50 %), whereas the disinfection by hypochlorite two hundred ppm reduced the overall counts by 9.9-6.8 log CFU/sponge (31 %). the typical reductions of CF (E. coli) - once boiling and hypochlorite disinfection- were 2.1 log CFU/ sponge (74 %) and 4.2 log CFU/sponge (50 %), severally, while 4.2 log CFU/sponge survived once hypochlorite disinfection.

There was a reduction of approximately 65-75% of all groups growth rate was to stainless steel surface, 31-68% to polyethylene surfaces and 17- 31 % to wooden surface. Stainless steel was the best surface to prevent bacterial contamination and survival of cutting boards using in kitchens.

Keywords: *Kitchen Sponges; Microbiological Contamination; Disinfection; cutting surface; Cross-Contamination*

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Introduction

Most of homes and workers are using sponges in cleaning food equipments and plates in kitchens.

Sponges may contain or to get rid of all food residues, which may consider as suitable environments for microbes (Redmon & Griffith, 2003).

Kitchen sponges are continuously used in the unit as a result of they'll stay wet and being nearly as good environments allowed all foodborne pathogens.

Contaminated Kitchen sponges accustomed wash dishes containing foodborne pathogens transferred Escherichia coli to surfaces a lot of of times than enter bacteria spp. (Mattick et al., 2003). Sponges contaminated with staph aureus, salmonella, and Campylobacter jejuni were ready to transfer pathogens to chrome steel surfaces, where S. aureus survived for up to four days. Similarly, pathogens transferred by sponges to chrome steel surfaces were later transferred to chop vegetables at variable rates (Kusumaningrum, et al 2003). It was found that throughout analysis, 10 kitchens within the United States of America, thirty third and sixty seven of sponges tested positive for E. coli and soiled coliforms (Josephson, Rubino, & Pepper, 1997).

Many studies have shown a the effects of sponges to spread pathogens is crucial to food safety due to the presence of those pathogens in unit kitchens for both gram positive and negative bacteria (Beumer & Kusumaningrum, 2003).

It was demonstrated that Cross-contamination is one of the most important factors of food-borne illness outbreaks (Greig and Ravel (2009),(Chen et al (2001). cross-contamination is commonly related to contamination of dishes or surfaces with laundry water, contaminated sponges, or contaminated things placed connected with them.

sponges may be necessary disseminators of pathogens and might be a reason of transferring microorganism to surfaces and utensils, that inflicting the contamination of food (Josephson et al (1997), Kusumaningrum et al (2003), Mattick et al (2003).

Also one of the most important equipments kitchens are stainless-steel, wood and polythene. However, the surfaces of those materials are irregular once discovered microscopically, therefore facilitating the deposition of organic matter and food residues, and contributory to microorganism attachment and survival (Sinde and Carballo (2000), (Kusumaningrum et al (2003).

The main objective of this study was:

- **To evaluate the microorganism contamination in kitchens sponge.**
- **Test the potential of disinfection methods in the survival of microorganisms in surfaces of stainless-steel, wood and polythene.**

Material and Method

Total of twenty four sponges (119 millimeter nine seventy six mm nine fifteen mm) were purchased at an area grocery store; were collected from four home kitchens (i.e., three sponges were collected from every kitchen (four groups).

Enumeration of total MesophilicAerobic bacterium, Staphylococci, Pseudomonas bacteria genus}, Salmonella, total coliforms and E. coli on used kitchen sponges.

Kitchen sponge was analyzed for the presence of total mesophilic aerobic bacterium, staphylococci, Pseudomonas, Salmonella, E. coli (Lancette and Tatini, 1992). Sponges were hold on at temperature (20-25 oC, 42± % humidity) all sponges were used for 0,3,7 and 14 days.

The sampled sponges were collected by sterile latex gloves, placed within sterile plastic luggage, and transported at temperatures < 5ºC to the Microbiological analysis and Diagnostic Laboratory.

(Rossi et al.2013).

Transfer and survival of heterotrophic microorganisms on surfaces of stainless steel, wooden and polyethylene

Sponges were totally rubbed 5 times on each stainless-steel, plastic and wooden cutting boards surface in order to make sure that all surfaces are fully contaminated.

The sponges were divided into four groups for this experiment. the (group 1) was composed of sponges contaminated with total MNP CFU/cm2 and therefore the second group (group 2) was composed of sponges contaminated with E. coli log CFU / sponge. The third cluster (group 3) was composed of sponges contaminated with enterobacteria log CFU/cm2. The (group 4) was composed of sponges contaminated **with staph log CFU/cm2.**

All cutting boards were left for at least 18 hours at room temperature, swabs were taken from each surface into agar plates and incubated at 36 oC for 48 hours, and microbial growth and count were expressed as CFU

Surviving rate= NF/NS x 100%, where NF= CFU from sponge and NS= CFU on surface by contact plate (Rossi et al. 2013).

Results and Discussions

Total mesopholic microorganisms were investigated in all sampled sponges (Table 1).

Table 1 indicated a major increase within the variety of log CFU/ml. the amount of E. coli was small, whereas Salmonella spp spp. was stabled, S. aureus was redoubled from the sponges throughout fourteen days. true bacteria was redoubled and was the dominant microflora within the sponges throughout fourteen days (Table 1).

The Cross contamination inside adequate storage or change of state was involved in several instances that is taken into account as a main frequency reason for illness (Olsen et al., 2000). In other studies, Dishcloths and sponges were found as a possible supply for spreading pathogenic microorganisms (Josephson et al., 1997).

The results showed that wet environments on all kitchen surfaces, were the most reason of contamination and also the incidence of doubtless harmful species. Conjointly it absolutely was found that dishcloths and similar improvement utensils, to be oft and heavily contaminated.

Data from this analysis also counsel that, raw food within the kitchen is perhaps the most supply of contamination, the sink, waste lure and close areas can even act as semi-permanent sources or reservoirs that harbor and encourage the growth of microorganism.

Table 1: Enumeration of total mesophilic aerobic bacteria, staphylococci, *Pseudomonas, Salmonella*, and *faecal coliforms* on used kitchen sponges.

Sponge	Microor-ganism	Day3	Day7	Day10
1	Mesophilic aerobic bacteria CFU/ sponge	5.8	6.2	6.8
2		6.2	8.2	9.1
3		5.6	6.2	8.3
4		5.1	7.0	8.8

Bacteria	Log CFU/ml			
	n	Day3	Day7	Day14
Pseudomonas	4	3.2	4.8	6.1
Salmonella	4	4.8	4.9	5.0
E. coli	4	6.8	5.8	5.7
S. aureus	4	0.3	0.8	0.9

Cross-contamination is taken into account because the most risk throughout regular domestic cleansing since sponges were found to be potential source of pathogens in kitchens (Hilton and state capital, 2000) and in step with the results all pathogens and bacterium were able to survive in sponges for a minimum of for seven days (Kusumaningrum et al., 2002).

Research by (Kusumaningrum et al., 2002; Hilton and state capital, 2000) recommend that almost microorganism activities in sponges depends on many factors, bacterium range and concentration are increasing quickly underneath the favorable conditions during a used sponge.

The sponges had CFU 9.9 log CFU/ sponge, among the analyzed sponges, 8.2, 6.5, and 5.5 log CFU/sponge wherever found to E. coli, Salmonella, and S. aureus severally (Table1).

Similar results were found by other researchers, Kusumaningrum et al.2002, United Nations agency determined about 6 log CFU/sponge in sponges used for 3 days in kitchens within the European nation. Also, Er-dogrul & Erbilir found 6.9 log CFU/sponge in sponges used for ten days.

Table 2: Bacteria reduction by disinfection methods sponge in collected sponge (log/ CFU/ml).

Log CFU/ml			
Bacteria	**Not disinfected**	**Disinfected by boiling**	**200 ppm sodium hypochlorite**
Total	9.9	4.7	6.8
E. coli	8.2	2.1	4.2
Salmonella	6.5	3.2	4.3
S. aureus	5.5	1.2	1.1

Disinfection Procedures

The disinfection methods employed in the study were found to be effective in reducing the count of bacteria; it was incontestable that boiling was the most effective disinfection methods. it had been ready to cut back the whole microorganism counts by 9.9 – 4.7 log CFU/sponge, almost as (50 %), whereas the medical care blanching agent 200 ppm reduced the whole counts by 9.9-6.8 log CFU/sponge (31 %).

The average reductions of CF (E. coli) -after boiling and blanching agent disinfection- were 2.1 log CFU/ml (74 %) and 4.2 log CFU/ml (50 %), severally, while 4.2 log CFU/ml survived when blanching agent disinfection methods Table 2).

Sharma et al.2009, was found a big reductions of the microorganism activities when exploitation disinfection methods with a 10% of blanching agent for 3 minutes, whereas boiling in an exceedingly kitchen appliance for one minute, that found to possess a higher result scrutiny to the blanching agent treatment.

Some microorganisms could survive the boiling; this method will eliminate solely half or variety of the microorganism population. It had been additionally found that microwave boiling was more practical than typical boiling for the inactivation of Bacillus subtilis.

The mechanism that will justify the potency of the boiling technique that, the hot temperature of the water that is ready to denature proteins and, consequently, destroy the semipermeable membrane integrity, inflicting the death of microorganisms.

Additionally, another necessary issue to be stressed is that in water boiling treatment, the sponge moves around among the liquid, creating the removal of a good deal of organic matter doable and, with that, higher heat penetration (Rossi et al 2012).

In several studies, it had been attainable to conclude that kitchen sponges will be expressively contaminated; however there are effective strategies for disinfection in the present study significantly reduced the bacterial counts, boiling was more effective than disinfection in 200 ppm sodium hypochlorite these results showed the adequacy of the boiling methodology. (Rossi et al 2012, Sharma et al.2009).

Transfer and survival of heterotrophic microorganisms on surfaces of stainless steel, wooden and plastic cutting board.

Large variation of contamination was found among results, that the sponges were divided into four groups for this experiment. the (group 1) was composed of sponges contaminated with total MNP CFU/cm2 and therefore the second group (group 2) was composed of sponges contaminated with E. coli log CFU / sponge.

The (group 3) was composed of sponges contaminated with enterobacteria log CFU/cm2. The fourth cluster (group 4) was composed of sponges contaminated with staph log CFU/cm2

(Table3). Table 3: Surviving rate of bacteria from sponge to stainless steel, wooden and plastic surface Contaminated with bacteria

Organism	Log CFU/cm2						
	CFU	Wood	Rate %	Plastic	Rate%	Stainless steel	Rate%
Total	9.2	7.6	83	4.8	52	3.2	35
E. coli	6.6	4.8	73	3.0	45	2.3	35
Salmonella	6.2	4.9	79	4.3	69	2.0	32
S. aureus	3.2	2.2	69	1.2	38	0.8	25

The transferred of microorganisms (time zero in table 3) was terribly high by sponges from all groups. Group one sponges transferred a median of 9.2 log CFU/cm2 of the initial contamination, 3.2 log CFU/cm2 to stainless steel surfaces and 4.8 log CFU/cm2 to plastic surfaces, and 7.6 log CFU/cm2 to wood surface. Whereas group of (E. coli) sponges transferred a median of 2.3 log CFU/cm2 and 3.0 log CFU/cm2 and 4.8 log CFU/cm2 to the surfaces of stainless steel and plastic, and wood surface respectively (Table3).

There was a reduction of roughly 65-75% of all groups rate to stainless steel surface, 31-68% to plastic surfaces and 17- 31 % to wood surface. Stainless steel was best surface to stop microorganism contamination and safe cutting boards in kitchens (Table3).

The results of the current study demonstrate that the sponges utilized in kitchens could also be contaminated by microorganisms, this was similar and corroborates with many previous studies (Josephson et al (1997), Erdogrul and Erbilir (2005), Hilton and state capital (2000), Kusumaningrum et al (2002). for instance, the counts of pathogenic CF which were the same as the results bestowed by Kusumaningrum et al. (2003) and Josephson and colleagues (1997)).

The presence of CF in kitchen sponges is worrying as a result of it reflects inadequate healthful conditions. Such contamination in sponges could come back from raw or boiled contaminated food, inadequate sanitary practices throughout food preparation, absence of disinfection procedures, cross-contamination because of contaminated surfaces, and storage in places wherever there's wetness and high temperatures when contamination, creating potential microorganism multiplication (Keeratipibul et al (2009), siimilar with the study of Mattick et al (2003), kitchen sponges will be contaminated throughout cleaning dishes contaminated with microorganisms which will be transferred to surfaces.(Kusumaningrum et al.2002).

There is a very important and constant risk of contamination transfer from the used surfaces; disposable sponges ought to be thought-about to be used whenever potential. As recommendation for Reusable sponges, sponges ought to be dried when use or immersed in boiling water for five min, a good means that of removing.

In this study, the risk has been thought-about to be down once the surfaces are dry, partially as a result of microorganism growth and survival would be reduced

by using stainless and plastic cutting board.

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