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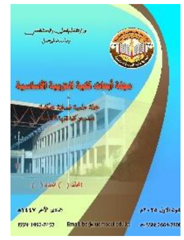

A Study of Bacterial Contamination of Kitchen Dishwashing Sponges in Mosul City

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Abstract

Kitchen sponges have a significant role in maintenance and spread of pathogenic strains that cause food-borne illnesses as well as rotting bacteria. Aim of this study was to identify kinds of bacteria that grow on common kitchen sponges. Results revealed that highest contamination rate, 65 (86.6%) of samples had Bacillus bacteria in them. While the lowest contamination rate was Klebsiella spp., which was isolated at a rate of (4%) from three sponge samples. It was discovered that Bacillus outnumbered other species. We also investigated effects of various sponge cleaning techniques. Results of current study also revealed variations in proportion of contaminated sponges based on techniques employed to handle sponges after dishwashing. The study discovered that leaving sponge in a container with tap water after usage resulted in highest proportion contamination proportion of (45.3), when sponge was pressed and stored in a dry container after usage, amount of bacterial contamination was at its lowest (5.3%). Additionally, our present investigation discovered a strong correlation between sponge's usage time and amount of bacterial infection. Percentage of contamination increases with length of use time. A sponge used for 14 days had the highest proportion of bacterial contamination (37.3%), whereas sponge used for 3 days had lowest percentage of contamination (12%). We use sponges every day to clean our dishes and surfaces, but in reality, we are spreading bacteria.

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دراسة التلوث البكتيري لإسفنجات غسيل الصحون في مدينة الموصل

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المستخلص

يلعب إسفنج المطبخ دورًا مهمًا في الحفاظ على السلالات المسببة للأمراض ونشرها والتي تسبب الأمراض المنقولة عن طريق الغذاء وبسبب أُستخدم إسفنج المطبخ على نطاق واسع فقد وجد أنها تحتوي على الكثير من البكتيريا التي تساهم في التلوث المتبادل للأيدي والأواني والطعام بمسببات الأمراض المنقولة بالغذاء. كان الغرض من الدراسة هو تحديد أنواع البكتيريا التي تنمو على إسفنج المطبخ .اظهرت النتائج ان اعلى نسبة تلوث كانت في 65 (86,6%) من العينات , حيث احتوت على بكتريا الباسيلس, في حين كانت بكتريا الكليبسيلا اقل تلوثا من بقية الانواع والتي تم عزلها من ثلاث عينات وبنسبة (4%) .كما توصلت الدراسة الحالية الى اختلافات في نسبة تلوث الاسفنج بناء على التقنيات المستخدمة في التعامل مع الاسفنج بعد عملية غسل الاطباق , حيث ان ترك الاسفنج في وعاء يحتوي على ماء الصنبور بعد الاستخدام ادى الى اعلى نسبة تلوث (45.3%) , اما ادنى مستويات التلوث(5.3%) فكانت عند عصر الاسفنج بعد الاستخدام وتركه في وعاء جاف .

كما وجدت الدراسة الحالية وجود علاقة بين المدة الزمنية لاستخدام الاسفنج وكمية العدوى البكتيرية، حيث تزداد نسبة التلوث مع طول وقت الاستخدام، وان اعلى نسبة تلوث بكتيري(37.3%) كانت في الإسفنج المستخدم لمدة 14 يوم، بينما الإسفنج المستخدم لمدة 3 ايام فكان اقل تلوثا (12%).نحن نستخدم الإسفنج كل يوم لتنظيف أطباقنا وأسطحنا، ولكن في الواقع، فإننا ننشر البكتيريا. اذ يعتبر العنصر الأكثر تلوثًا في المنزل.

الكلمات المفتاحية: التلوث الميكروبيولوجي، طرق التنظيف التي يتبعها المستهلك، مدة استخدام الإسفنجة، التقنيات المستخدمة في التعامل مع الإسفنج.

1. INTRODUCTION

It is commonly known that sponges are used to remove food residue during the prewashing and washing stages of cleaning kitchen sinks and cutlery (Dey *et al*., 2020). In most countries, sponges were the hand cleaning instrument for washing up (Al-Taweil1 *et al*., *2020*).

Everyday kitchen sponges made of synthetic material are used to clean surfaces like countertops, silverware, tables, and dishes (Knoll, 2019).

Customers frequently use kitchen sponges to scrub and clean pots and casseroles (Patricia and Jennifer, 2017), Cellulose and fiber are used in the construction of the kitchen sponges (Lagendijk *et al*., 2008).

It known that kitchen sponges are crucial for the spread of pathogens and that foodborne illnesses are mostly caused by foodborne infections. Food-borne diseases may be stored in such sponges (Wolde and Bacha ., 2016 ; Azevedo *et al.,* 2014) .Pathogens can be spread by infected sponges to surfaces that come into contact with components, and those microbes can persist on those surfaces for hours or days following infection (Kusumaningrum *et al*., 2002).

Many household kitchen sponges are kept in packing containers with water and food residues at room temperature, which might encourage the growth of bacteria (Møretrø *et al*., 2022)The residues form a hot zone for numerous bacteria species to the cleaned food items stick to the cleaning sponge. Numerous species are more likely to proliferate on the surface of sponges due to the dampness associated with sponges (Dey *et al.*, 2020). It has been effectively observed that the most effective household carrier for the spread of pathogenic microorganisms is these kitchen sponges (Speirs *et al*.,2008) . Usually, the transfer happens as a result of cross-contamination between the sponge and utensil surfaces (Finch *et al*., 1978). According to research, salmonella is the main microorganism that causes illnesses and infections in unclean kitchens (Di - Cerbo *et al*., 2021).Salmonella can transfer from your hands to kitchen surfaces and from a sponge to your hands (Marotta *et al*., 2019) .Beginning on the first day, salmonella consistently developed at higher concentrations than in the other sponges (Møretrø *et al*., 2021). All sponge species had a one-day survival rate for Campylobacter, while two out of three kinds had a seven-day survival rate for Salmonella. A different study revealed that the variety and quantity of bacteria present in kitchen sponges exceeds that of bacterial culture dishes in labs. In a related study, researchers at the University of Furtwangler in Germany looked at 14 sponges that were taken. After looking at the used sponges, the researchers discovered that the sponges contained more than 362 different kinds of bacteria that cause the disease. Listeria, Campylobacter, Bacillus cereus, and other bacterial illnesses are also linked to polluted kitchen environments. Pathogenic microorganisms, including *Staphylococcus aureus* and *Escherichia coli*, were identified from 34.3% of synthetic washing sponges (Byrd-Bredbenner *et al*., 2013). *Staphylococcus aureus* and Enterobacteriaceae were commonly found (Evans and Redmond, 2019). In most countries, sponges hand-cleaning instrument for washing up (Hilton and Austin, 2000).Dishwashing sponges are thought to be the most prevalent household item. They are known to have potentially fatal bacteria like "*Moraxella osloensis*" and "*Chryseobacterium hominis*," which are among the main causes of serious illnesses in humans. includes "stagnant" bacteria, also known as "Acinetobacter," which the World Health Organization considers to be among the most harmful kinds of bacteria because of their strong antibiotic resistance. Since moisture is a key component that supports bacteria, the sponge is variety of bacteria that thrive and reproduce there because of the moisture that is present in between its pores and on its surface throughout the day (Kagan *et al*., 2002). The reason behind the swift development of germs in kitchen sponges is their constant moisture content and the build-up of food remnants, which serve as a bacterial food source. To lower the risk of contracting these germs, you should disinfect any kitchen surfaces that come into contact with them, such as the kitchen sink and water faucet (Christina *et al*., 2022). Most women do not replace the sponge with a fresh one; instead, they use it for several weeks until the fat builds up and breaks down. Studies by scientists and microbiologists regard such actions as a typical error (Byrd-Bredbenner *et al*., 2013).

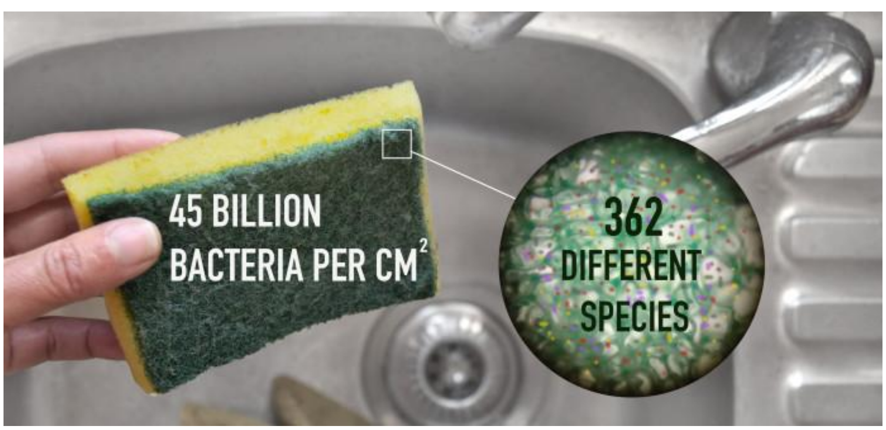

Fig. 1: 362 distinct kinds of bacteria have been found in kitchen sponges.

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It is very difficult for consumers to avoid bacterial growth on sponges if they are not replaced daily, and consumers' usage habits have little effect on bacterial growth. More than 362 distinct species of bacteria were discovered by researchers on dishwashing sponges while cleaning kitchen items. Sponges are commonly used for washing up and some food residue may eventually stick to the sponges, the food residue and moisture that sponges retain create an aerobic environment for bacteria to grow and survive. According to a report, these highly polluted sponges may be the primary means by which potentially harmful germs spread throughout the back of house environment (Argudín *et al*., 2010; Kumie *et al*., 2002; Flores *et al* .,2013). The sponge should according to research , and if getting rid of it is difficult, it should be cleaned in a washing machine at a very high temperature with bleach and (Ruocco *et al*., 2017).

Using a dishwasher or microwave to clean your sponges is the best option boiling or microwaving the sponge can help lower its bacterial count, but these techniques won't guarantee that the sponge is clean on its own since it eliminates weak bacteria but leaves disease-causing, powerful bacteria alive (Celandroni, *et al*., 2004). It is advised that you discard your sponge, if not more frequently because they are home to a wide variety of dangerous microorganisms that can cause illnesses. Based on their findings, researchers advise washing dishes using a brush rather than a sponge because brushes have less areas for bacteria to hide than sponges. Additionally, they dry more quickly, which reduces the bacterial habitation. Since sponges can hold more than 54 billion germs per cubic centimeter—the same amount of bacteria found in a toilet—they are thought to provide a favorable environment for the growth of bacteria (Cardinale *et al*., 2017). According to studies, there are seven to eight times as many bacteria per square centimeter in sponges as there are people on the planet. It was discovered that a very tiny portion of a sponge—no larger than an inch—may hold a very high concentration of bacteria reaching billions, and this microbial count is comparable to that of a human feces sample. Unfortunately, considerable amounts of bacteria are still present in sponges even after regular cleaning. Dishwashing sponges are an ideal habitat for the growth of germs that are extremely dangerous to human health, according to research conducted by German scientists (Gorman *et al*., 2002). A 2017 study that was published in the journal "Scientific Reports" revealed that disease-causing species were present in kitchen sponges. The study recommended replacing the sponge once a week because infection-causing pathogenic bacteria and viruses are more likely to persist even after frequent cleaning (Byrd-Bredbenner *et al*., 2013).

2. MATERIAL AND METHODS

2.1 MATERIAL

1-Media used :- Nutrient agar , blood agar and MacConkey agar.

2-Chemicals:- Hydrogen Peroxide and Kovacs oxidase reagent.

2.2 METHODS

1-Sample collection:- Seventy-five kitchen sponge samples were gathered from the homes of randomly selected healthy persons in Mosul. The samples were collected between August 2024 and July 2024. In the current investigation, sponges from residential kitchens that had been used for at least two weeks were used. In the current study, sponges that were utilized in home kitchens for three days to two weeks were used. Samples of sponges and an unused sponge (control) were used in kitchens on a daily basis, at least twice a day, in conjunction with dishwasher detergent. The purpose of the questionnaire was to gather data regarding how long the sponge has been in use, how many times dishes are washed with it in a single day, and how the sponge is treated once the cleaning is done. The samples were collected using sterile latex gloves and deposited in sterile tubes holding 1 ml of nutritional broth. The samples were then plated onto agar plates, blood agar plates, and MacConkey agar plates and incubated at 37 C° for 24 to 48 hours.

2.3 Isolation detection

A. Gram stain:- Gram stain testing is used to determine the type of bacteria.

B. Biochemical tests :- Additionally, biochemical testing was done to identify the different kinds of bacteria. To perform the catalase test, tiny drops of 3% Hydrogen Peroxide were applied to agar plates that had an overnight culture started in order to produce air bubbles. Kovacs reagent was used to detect coli bacteria and cytochrome oxidase assay was performed ,the appearance of blue color within minutes is considered a positive result.

3. RESULT AND DESICCATION

Every day at least twice a day, the sponges used in houses were updated with the detergent. Sponges of households

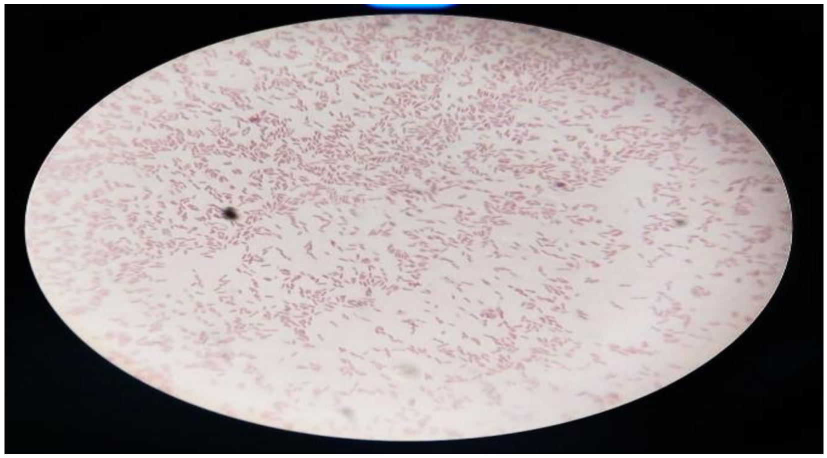

Fig.2:Gram negative rods **bacteria found from the samples (100X).**

(Table 1) 1displays the findings of microbiological analyses of sponges for a total of 75 samples of microorganisms, including gram-negative bacilli, staphylococci, streptococci, enterobacteria, bacilli, and Klebsiella species. While enterobacteria were identified from 43 samples (57.3%), bacilli were found in 65 (86.6%) of the samples, which had the greatest contamination rate. Streptococci were found in 31 sponge samples (41.3%), while staphylococci were found in 17 sponge samples (22.6%), and five samples (6.6%) were isolated from gram-negative bacteria. Klebsiella, the bacteria that generated the least amount of contamination, was detected in three sponge samples at a rate of 4%. It was discovered that bacilli were more common than other species. These results confirm previous research that claimed that kitchen sponges provide a friendly environment for bacteria to grow.

Table 1: lists the predominant bacteria discovered in kitchen sponges collected from homes in Mosul City.

Types of bacteria	**Number of Positive Samples (n = 75)**	**Prevalence (%)**
Bacilli	65	86.6
Enterobacteria	43	57.3
Streptococci	31	41.3

Staphylococci	17	22.6
Gram-negative rods	5	6.6
Klebsiella	3	4

This investigation aligns with the findings of Healy et al.'s study, which indicated that the most common genera were bacillus 10%, streptococcus 7 %, lactobacillus 3%, micrococcus 8%, etc. The prolonged use of the sponge in unsanitary and unhealthy settings could be the cause of the contamination seen in the samples. It was discovered that Bacillus outnumbered other species. Pseudomonas generally thrives in humid environments its drying-sensitive (Healy *et al*., 2010; Flores *et al*., 2013; Møretrø and Langsrud, 2017). Acinetobacter and Pseudomonas bacteria predominated in kitchen sponges according to a different German investigation (**Jacksch** *et al*., 2020). As previously mentioned, pathogenic species and bacteria such as Pseudomonas sp., Bacillus sp., and Streptococcus sp. are commonly found in all parts of the home environment. Consequently, high pollution and the presence of potentially dangerous species are most frequently linked to damp locations, such as restrooms, kitchen sink areas, and diaper pails. It is inappropriate when coliforms are present since it indicates unsanitary circumstances , Cardinale *et al*. (2017) discovered that Acinetobacter, Moraxella, and Chryseobacterium were highly colonized in 14 used sponges that were gathered in Germany, whereas Acinetobacter, Enhydrobacter, Agrobacterium, Pseudomonas, and Chryseobacterium dominated (Cardinale *et al* ., 2017), in another German study of 20 sponges In these kitchen sponges, the Pseudomonas, Bacillus, Micrococcus, Streptococcus, and Lactobacillus families were also frequently discovered (Jacksch *et al* ., 2020) . Transfer of germs from the sponge to the hands and then to the mouth, either directly or through food, or from the sponge to surfaces and equipment and then to food, is most likely the cause of pathogen ingestion from using sponges. Most bacteria have the ability to be transferred from the sponge to the mouth via the hands. (Bremer *et al* 2001; Luber and Bartelt 2007).

Urinary tract infections and diarrhea are the main illnesses that these kitchen sponges' poor cleanliness causes. Pregnant women, young children, elderly seniors, and patients with immune system suppression are typically the primary casualties (Healy *et al*., 2010).

This implies that due to inadequate hygiene standards, a notably high percentage of industrial kitchen sponges in numerous houses in Mosul City are infected with bacteria of fecal origin. The large quantity seen in the kitchen sponge samples could be a sign of improper heating temperature utilized during washing or post-washing to spread the amount of coliform bacteria on typical kitchen surfaces was examined in a 2011 National Sanitation Foundation study. Coliforms are rod-shaped, gram-negative bacteria that originate in the feces. This investigation revealed that coliform bacteria were present in 75% of the sponges from 22 families (Hayes *et al* ., 2004) Kitchen sponges contaminated with foodborne pathogens were used to wash dishes, which frequently spread *Escherichia coli* bacteria to surfaces more frequently than other bacteria(Mattick et al., 2003) Salmonella, *Campylobacter jejuni*, and *Staphylococcus aureus*-contaminated sponges were capable of to spread germs to surfaces made of chrome steel. During the course of the investigation, it was discovered that 33 and 67 sponges from 10 kitchens in the United States of America tested positive for dirty coliforms and *E. coli* (Josephson et al., 1997). The current study's findings, which are consistent with other earlier investigations, show that sponges used in kitchens may also be contaminated by germs. Sponge contamination can result from a variety of sources, including cross-contamination from contaminated surfaces, poor hygiene during food preparation, and storage in unsanitary conditions (Rusin *et al* ., 1998 ; Hilton and Austin ., 2000; Borrusso and Quinlan .,2017).To favorable conditions like high humidity, the presence of organic residuals, and promiscuous use, sponges provide an ideal environment for colonization and subsequent microbial replication. Researchers were able to isolate Pseudomonas (16.9%),Bacillus (11.1%), Micrococcus (10.6%), Streptococcus(7.8%), and Lactobacillus (6%) as well as other dominant bacterial genera from 377 kitchen sponge samples, aside from the unidentified Gram-positive rods (4.9%) and Gram-negative rods (9.9%) (Ryu and Beuchat .,2005).

As seen in Fig.3 :we examined the effects of various cleaning techniques on these kitchen sponge samples in the current investigation.

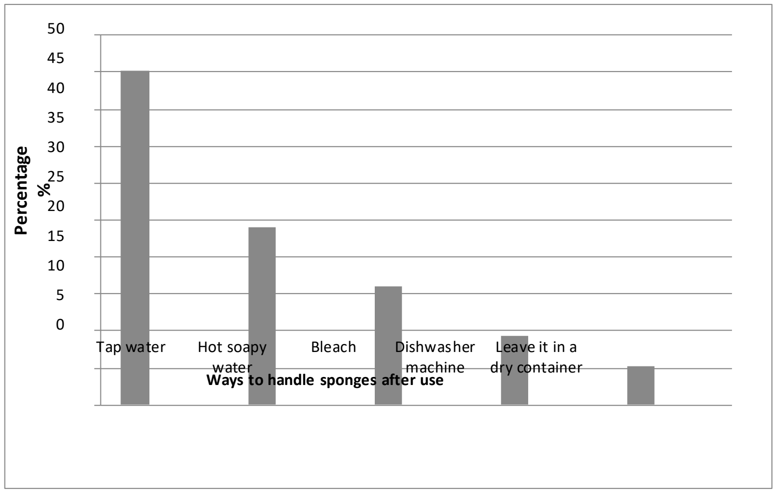

Fig. (3): Showing the relationship between the Ways to handle sponges after use and the percentage of bacterial contamination

According to the study, leaving a sponge in a container with tap water after use resulted in the highest percentage of contamination (45.3%), while leaving a sponge that had been squeezed and placed in a dry container after use resulted in the lowest proportion of bacterial contamination (5.3%). While the percentage of contaminated sponges left in hot, soapy water was (24%), the percentage of contaminated sponges left in bleach after use was (16 %), and the number for sponges cleaned in the dishwasher machine after use was (9.3 %), although there is little data on how various cleaning utensil usage practices impact bacterial variety and levels, it is known that humid cleaning utensils have greater bacterial counts than dry cleaning utensils (Cogan *et al*., 2002; Moen *et al* 2023) .Numerous investigations have demonstrated that frequent sponge cleaning increases the quantity of opportunistic microorganisms such as Pseudomonas and Enterobacteriaceae. Among these bacteria, the three most prevalent ones in were Acinetobacter, Enterobacteriaceae, and Staphylococcus (Mattick et al., 2003) Compared to that are kept wet, that are allowed to dry between usage have fewer bacteria. Common sponge bacteria are categorized as pathogens, which infect people, particularly the immunocompromised and sick children in general (Evans and Redmond., 2018).Certain species of bacteria are also capable of withstanding boiling, which explains why they persist in high-temperature liquids and solutions like hot, soapy water. The impact of hot water, soap, or microwave use on the microorganisms found in kitchen sponges has been the subject of numerous research. A minor variation in the quantity of germs between these "cleaned" and uncleansed sponges was noted by the researchers. According to the researcher's data, there was no discernible change in the bacterial load between the treated and unsterilized sponges. Indeed, they showed that two distinct taxa, Moraxella and Chryseobacterium, were more abundant

after cleaning by 20% and 15%, respectively (Healy *et al* ., 2010).
These two genera belong to the risk category 2 of bacteria, which are microorganisms that infect people and cause illness. The Streptococcus genus of bacteria and the Herpesvirus family of viruses are considered risk 2 species. Gram-negative, rod-shaped, non-spore-forming Chryse bacterium is classified as Risk 2. It can be found in raw meat and milk (Evans and Redmond ., 2018).
(Quinlan., 2013) found that the best way to sanitize sponges is by microwaving, which has proven to be more effective at killing bacteria than cleaning sponges with deionized water, lemon juice (pH 2.9), 10% Clorox A solution, or washing them in the dishwasher. Chemical treatments and tap water treatment have shown high bacterial survival (Sharma *et al.,* 2009).

It was proposed that the ineffectiveness of the bleach was due to the sodium hypochlorite found in the bleach which may have become inactivated due the amount of organic soils present in the sponge derived from the food (Mokgatla *et al*., 1998). Another hypothesis states that bacteria adhere to the surface of the sponge and form a biofilm that prevents the hypochlorite in the bleach from penetrating the sponge's interior and killing the microorganisms within (Ryu and Beuchat*., 2005*).

Planktonic bacteria such as Staphylococci, Pseudomonas, and *Escherichia coli* can form and evolve a whole biofilm in as little as two to four days if the proper circumstances are met and they have a sufficient population, according to an experimental study. Antiseptics and disinfectants may not be able to stop biofilm-forming bacteria from evolving resistance.(Phillips *et al.,* 2010).

They discovered that between 21 % and 43 % of the bacteria in sponges can transfer to a new surface (Knoll ., 2019). The unusually high number could have been caused by inadequately sanitizing kitchen sponges, cleaning with the same sponge repeatedly, and unsanitary conditions in the food service establishments , as observed during data collection. More worryingly, these results do not significantly reduce the microbial load in kitchen sponges, unlike dishwashing soaps or chemical compounds (Sharma *et al.,* 2009).

Sponge residue use, which may promote the growth of bacteria. On the other hand, rapid or at least halt the growth of the bacteria (Ojima *et al.,* 2002) Sharma et al. (2009) found that the amount of bacteria (*Escherichia coli* Klebsiella , Enterobacter, Serratia and Proteus) present was reduced when a sponge was heated for one minute in a microwave oven. Rather than buying new brushes and sponges, you might be able to clean them in a boiling water bath, the dishwasher or with chlorine (Sharma *et al*., 2009). In addition, these bacteria reproduce and spread on all kitchen surfaces and dishes that we believe to have been cleaned, according to Dr. Philippe Delicta , a professor of microbiology at the University of Michigan in the United States. It is not recommended to use kitchen sponges to absorb liquids or blood released while chopping meat or poultry on cutting boards. because it promotes the growth of bacteria," he said, suggesting that kitchen must be cleaned instead using antibacterial paper towels and disinfectant sprays (Christina *et al* ., 2022)Kitchen sponges that are allowed to dry between uses have less bacteria than ones that are kept moist. However, there's no agreement on the best way to clean sponges to reduce the amount of bacteria they contain. Although there are very few studies that agree with Quinan's findings that hot water and soap have no significant effect on the number of bacteria on sponges used to clean dishes, other research has shown that immersing sponges in boiling water significantly reduces bacterial counts. (Rossi *et al.,* 2012). In a study by Tate (2006) 48 kitchen sponges were used for two weeks before being gathered and cleaned using different sanitation methods. Researcher Tate noted through a study he conducted on sponges that the number of bacteria decreased by 47.2% in sponges used for washing dishes when placed in the microwave or boiled for ten minutes, compared to untreated sponges. (Ryu and Beuchat.,2005).While rinsing sponges in warm, soapy water may help inhibit the formation of bacteria, the soap may stay in the sponge and result in soap scum (Finch *et al* ., 1978). A pale gray film that covers a surface is called soap scum and is caused by a combination of calcium and magnesium particles in the soapy water. Even though the amount of bacteria transferred from sponge to surface increased, cleaning methods did release more germs onto the surfaces. Bacteria may proliferate in scum and spread rapidly (Lee, *et al* ., 2007)The reason for the bleach's inefficiency was proposed to be the sodium hypochlorite in it, which may have become inactivated because of the amount of organic compounds in the sponge produced from the flesh. An alternative explanation posits that fungal and bacterial cells adhere to the surface of the sponge, forming a biofilm that prevents the hypochlorite-containing bleach from penetrating the sponge's interior and eliminating the microorganisms within(Ryu and Beuchat ., 2005). According to an experimental study, planktonic bacteria such as Staphylococci, Pseudomonas, and *E. coli* can form and evolve a whole biofilm in as little as two to four days if the correct conditions are met and they have a large enough population. Bacteria that form biofilms may become increasingly resistant to disinfectants and antiseptics.(Cardinale *et al* ., 2017), (2010)Phillips and associates. Most of the bacterial colonization on the surface of the sponge indicated the presence of a biofilm within the internal cavity's walls (Phillips *et al.,* 2010*)*.We also examined the relationship between the amount of pollution on the dishwashing sponge and its usage duration in the current investigation. It was shown

that there is a direct association between them, as shown in Fig.4: the longer the sponge is utilized, the

higher the percentage of bacterial infection.

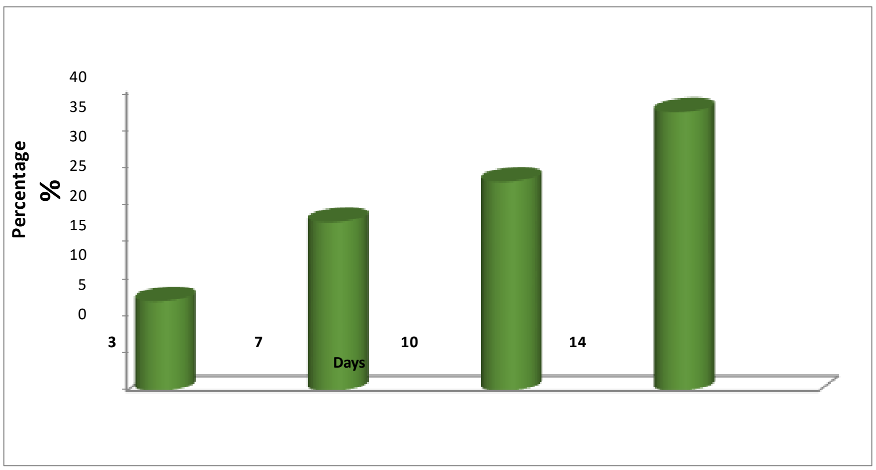

Fig. (4): showing the relationship between the time period of using sponges to wash dishes and the percentage of bacterial contamination.

The sponge that was used for three days had the lowest percentage of contamination (12%), while the sponge that was used for fourteen days had the largest proportion of bacterial contamination (37.3%). The sponge that was used for seven days had a (22.6%) bacterial contamination rate, while the sponge that was utilized for ten days had an (28 %) contamination percentage. After two weeks of use, there was only a 0.4% increase in log10 in the bacterial abundance, showing stable bacterial loads and no discernible relationship between the bacterial load and the amount of sponge used. This study confirms findings from prior studies showing bacteria The findings of this study are consistent with past research that *S. aureus* bacteria may survive for up to four days (Mattick et al., 2003).Our results confirm that bacteria colonize and multiply quickly in kitchen sponges, and that a high bacterial population remains there after use. Several studies agree that kitchen sponges harbor a substantial bacterial build-up (Sharma *et al.,* 2009 ; Cardinale *et al* ., 2017) , Several studies agree that kitchen sponges absorb more bacteria the longer they are used two weeks passed with a relatively large number of bacteria, despite the expectation of a weekly increase in the number of germs (Quinlan ., 2013). There is a relationship between the quantity of time used and the quantity of germs and percentage of contamination since the bacteria are persistent within the pores of the sponge. There are food remains here, which can give bacteria a good environment (Jevšnik et al ., 2008).

4. CONCLUSIONS

Cleaning the sponge every day and changing it once a week is advised, particularly if you work in sensitive environments like cafeterias or hospitals or if there is an old or sick family member living there. While washing dishes, it is better to use a brush rather than a sponge. Compared to a sponge, there is less chance of bacteria developing on the brush because it dries more quickly. With the handles on the brush, bare hands are kept out of the water, allowing for higher temperatures and a more effective cleaning result. Using the brush won't infect hands because pathogens won't go from the brush to bare hands. This is risky when using a sponge, and using a dishwasher makes cleaing the brush simple. Since brushes are thought to be more hygienic than sponges, using them should be promoted.

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