Spongy Heaven for Microbes: A deep dive into the science of microbial growth in your domestic used sponge

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Abstract

Background: Our environment is full with microorganisms, and they can get into unanticipated locations like our household cleaning aids. These microorganisms may cause harmful diseases in humans. This article explores the fascinating world of microbial development on domestic sponges and clarifies the elements that contribute to their colonization and potential hazards. Several methods of testing used to recognize and study these microorganisms.

Objective: The main objective of this study is to examine the factors contributing to microbial growth in household sponges, including the types of microorganisms involved and their potential health implications.

Methodology: We gathered 20 samples from different homes and hotel kitchens. We have tested different samples in this study by analytical methods. Using a sterile knife, each sponge divided into three pieces and each sponge coded. The sponge portions had an average size of 3 cm by 2 cm by 1 cm. The sponge's first portion microbiologically examined at the first hour of examination.

The second and third halves of the sponge were stored separately for three and ten days in a sterile, uncovered plastic container at room temperature (21 °C).

Result: Aside from the unidentified Gram-positive rods (6.9%) and Gram-negative rods (13.9%), the dominating bacterial genera were S. aureus (15.5%), E. coli (9%), Pseudomonas, (27%), Enternobacteracae, (7.8%), Klbsiella (13.9%) and Salmonella (6%). Gram-positive species made up 68% of the sponges overall, whereas Gram-negative organisms accounted for around 32% of mesophilic bacteria. Among the aerobic mesophilic bacterial flora of kitchen sponges, Pseudomonas spp. constituted a rather high proportion (27%).

Conclusion: The conclusion of the study is to present key findings and scientific insights into the dynamic relationship between sponges and microorganisms as well as raise awareness about the importance of sponge maintenance and regular replacement for a healthier living environment.

Keywords: Microorganisms1, Hygiene2, Ecosystem3, Microbial Growth4**,** Kitchen Sponges5,

Introduction

The kitchen sponge is a seemingly harmless but potentially growing ecosystem that lives in the center of every home, among the daily chaos. A common sight in kitchens across the globe, the humble sponge plays an unsung hero role in the fight against dirt and grease. However, beneath its porous surface, a world unseen and filled with microbiological life emerges.[i]

Using two different techniques— Muller Hinton agar broth culturing and Nutrient broth this research study starts on an intriguing trip into the microscopic world of the everyday in an effort to solve the mystery surrounding the microbial the population of household sponges.[ii]

We culture and isolate the bacteria living on these sponges using the Ager Broth method, a traditional microbiology technique, in order to get better understanding about their diversity and growth traits. After being incubated at 37 degrees Celsius, such microorganisms were found including Gram positive (S. aureus, Enterococcus) and Gram negative (Klbsiella, Salmonella, E coli, Pseudomonas) strain were counted on MacConkey agar and on Muller Hinton Agar (OXOID).

Each of them have their specific nature like, Gram-positive Staphylococcus aureus (S. aureus), and this bacterium known for causing a wide range of infections in humans. It can result in skin infections such as boils, cellulitis, and impetigo, as well as more severe conditions like pneumonia, endocarditis, and toxic shock syndrome.[iii] S. aureus is also notorious for its ability to produce toxins, contributing to food poisoning when contaminated food ingested. Enterococcus species commonly found in the gastrointestinal tract and are often harmless; certain strains have developed resistance to antibiotics, posing a challenge in healthcare settings. Enterococcal infections can cause urinary tract infections (UTIs), wound infections, and bloodstream infections (bacteremia) which can be severe, particularly in individuals with weakened immune systems[iv].

Gram negative like Klebsiella causes Klebsiella infections most commonly affect individuals with weakened immune systems or those receiving healthcare. It can cause various infections including pneumonia, urinary tract infections (UTIs), bloodstream infections (septicemia), and infections in wounds or surgical sites. Some strains have become resistant to multiple antibiotics, making treatment challenging.[v]

Salmonella can cause Salmonella infections, often contracted through contaminated food or water, lead to a condition called salmonellosis. Symptoms include diarrhea, abdominal cramps, fever, and vomiting. In severe cases, especially among vulnerable populations, the infection can spread from the intestines to the bloodstream and cause severe illness requiring hospitalization.[vi]

Figure 1 Microbes after incubation

Many strains of Escherichia coli (E. coli) are harmless and naturally occur in the intestines of humans and animals but it is opportunistic bacteria so it may cause severe illness. This bacterium is a common cause of foodborne illness and can result in symptoms ranging from mild diarrhea to more severe complications like hemolytic uremic syndrome (HUS), which can lead to kidney failure and, in some cases, be life threatening.[vii]

Pseudomonas causing pseudomonas infections primarily affect individuals with weakened immune systems or those with underlying health conditions. Pseudomonas species can cause infections in various parts of the body, including the respiratory tract, urinary tract, skin, and wounds. Infections can range from mild to severe, and some strains are resistant to multiple antibiotics, complicating treatment.[viii]

Methodology

Sponges chosen from different house and hotels gathered aseptically and transported to the Laboratory of Microbiology, Hamdard University in germ-free polythene bags. Using a sterile knife, each sponge divided into three pieces and coded all pieces accordingly. The sponge portions had an average size of 3 cm by 2 cm by 1 cm. After receiving, within an hour, the sponge's first portion microbiologically examined. The second and third halves of the sponge were stored separately for three and ten days in a sterile, uncovered plastic container at room temperature (21 °C).[ix] [x] Before the samples subjected to a microbiological analysis, measurements were made of the weight and water activity of the inner and outer portions of the sponge samples at times 0, 3, and 10 days. [xi] For identifying microorganisms, kitchen sponges combined with Nutrient broth plated in triplicate on dry surfaces of Muller Hinton agar and MacConkey agar (OXOID). Consequently, after twenty-four hours of incubation at thirty-seven degrees Celsius, standard plate counts were performed on Standard Plate Count Agar (SPCA) (OXOID); coliforms were counted

using VRBA (OXOID) after forty-eight hours of incubation at thirty-seven degrees Celsius. After incubated at 37 degrees Celsius for 24 hours, E. coli, *pseudomonas, Enternobacteracae,* S. aureus, *Klbsiella* and *Salmonella* counted on MacConkey agar and on Muller Hinton Agar (OXOID). Colonies that were pink to red purple and had or did not have precipitation haloes considered Enterobacteriaceae.

Results

Too many bacterial strains identified with different genera and bacterial groups from kitchen sponge samples taken from eateries, homes and hotels. Aside from the unidentified Gram-positive rods (6.9%) and Gram-negative rods (13.9%), the dominating bacterial genera were S. aureus (15.5%), E. coli (9%), *Pseudomonas,* (27%), *Enternobacteracae,* (7.8%), *Klbsiella* (13.9%) and *Salmonella* (6%). Gram-positive species made up 68% of the sponges overall, whereas Gram-negative organisms accounted for around 32% of mesophilic bacteria. Among the aerobic mesophilic bacterial flora of kitchen sponges, Pseudomonas spp. constituted a rather high proportion (27%).

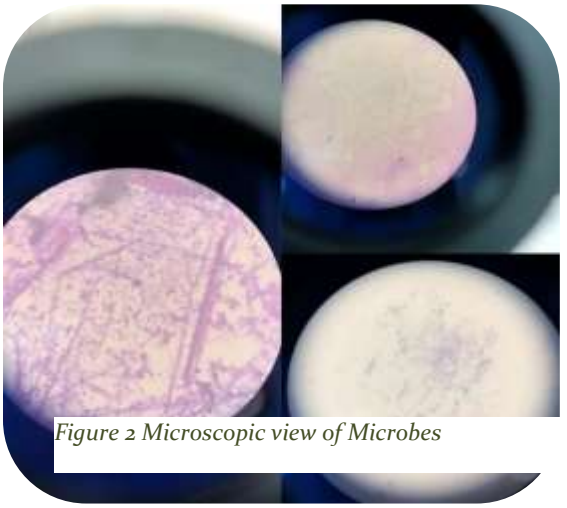

Figure 2 Microscopic view of Microbes

The outcome reported by Muller Hinton agar and MacConkey agar Salmonella, Enterobacteracae, E. coli, and Staphylococcus aureus are all growing on agar and in nutrient broth, in addition to fungi like molds and yeasts. These microbes discovered on sponges that gathered from 12 separate homes and 8 restaurants. Due to their frequent use, restaurants have a huge number of microorganisms.

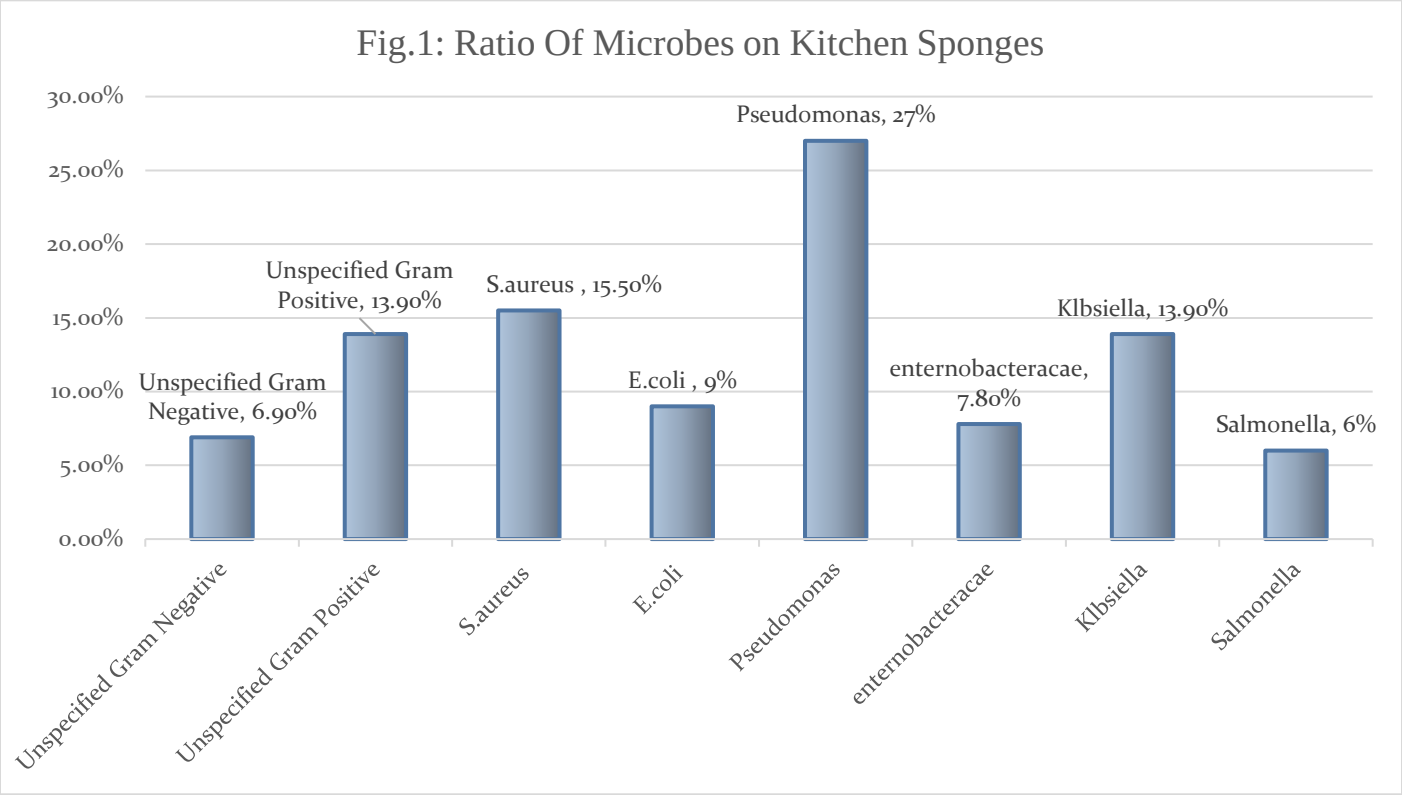

Figure 3 Graph

Conclusion

The intriguing and sophisticated ecosystem that exists within the sponges in our homes is a hidden world of bacteria that thrives there. Even though these little organisms frequently go unseen, their influence on our daily lives was unavoidable. These bacteria serve a critical role in preserving the cleanliness and wellness of our houses by contributing to the breakdown of organic materials and possibly harboring dangerous infections. It is essential to understand that not all the sponge microbes are dangerous.[xii] [xiii]Many are advantageous and support the natural equilibrium of our environment. However, it is crucial to adopt regular cleaning habits and correct sponge maintenance to ensure the safety and hygienic of our living spaces and to lower the chance of dangerous bacteria and pathogens propagating within these porous cleaning instruments.[xiv] Food residue, grease, and moisture build up on sponges over time, creating the perfect environment for germs to flourish, including dangerous diseases produced by microbes like Salmonella and E. coli. When an old sponge is in contact with kitchen surfaces or utensils, the bacteria can spread quickly in the warm, damp environment of the sponge, raising the risk of foodborne infections.[xv] Use of certain contaminated sponges may lead to the several pathological conditions like food borne illness, skin irritation, dermatitis, stomach problems. To overcome such conditions, we should

change sponge every week. Use of new sponge will reduce the chances of such diseases and help to increase the hygiene. This deeper understanding also highlights the importance of broader hygiene practices. It is not just about the sponge, it is about the entire kitchen ecosystem. Cross-contamination from sponges to utensils or countertops poses risks. Therefore, adopting a holistic approach to cleanliness, regularly disinfecting surfaces, washing hands diligently, and storing food properly can prevent potential illnesses.[xvi]

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