

# Isolation And Characterization of Kitchen Microbiome in Jaipur District

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## ABSTRACT

The COVID-19 pandemic has underscored the critical role of household hygiene in preventing infectious diseases. This study investigates the prevalence and characterization of bacteria in kitchen environments, focusing on the effectiveness of 70% ethanol disinfection. Samples were collected from five areas in the kitchens of 10 households both pre- and post-disinfection. Detailed microbial analysis revealed significant reductions in colony counts post-disinfection. A total of five bacterial pathogens viz. *Escherichia coli*, *Staphylococcus* spp., *Klebsiella pneumoniae*, *Salmonella* spp., and *Enterobacter* were identified across kitchen area types. Each kitchen area contained at least one contaminated surface. The total number of bacterial pathogens in pre-disinfected kitchen areas was significantly higher as compared to the post-disinfected regions with 70% alcohol highlighting the need for regular and effective disinfection practices to minimize health risks associated with household microbial contamination. Results suggest that low-income consumers may be at risk of foodborne pathogen exposure from contaminated home kitchen surfaces and that regular disinfection with 70% ethanol effectively reduces microbial contamination in household kitchens.

**Keywords:** microbial contamination, household disinfection, ethanol efficacy, kitchen hygiene, public health

## INTRODUCTION

Inappropriate ventilation with high humidity results in the proliferation of bacteria on visible and hidden surfaces. Observing the omnipresent bacteria in household kitchens and the potential implications for food safety and public health is fascinating. Studies conducted by Ojima et al. (2002a, 2002b), Sinclair and Gerba (2011), Luber (2009), Berger et al. (2010), Cogan et al. (2002), Scallan et al. (2011b), and Scott et al. (1982) underscore the critical nature of maintaining proper kitchen hygiene. Kitchen sponges offer an ideal place for

harmful bacteria and other pathogens such as viruses to grow. Some of these pathogens include *E. coli*, *Salmonella*, *Klebsiella pneumoniae*, and *Enterobacter cloacae* (Ikawa and Rossen, 1999). Foodborne pathogens such as *Campylobacter*, *Salmonella*, and *Listeria* are known to inhabit kitchen environments, accentuating the necessity for stringent sanitation practices. Bacteria, both Gram-negative and Gram-positive, thrive on various kitchen surfaces, with moist areas typically exhibiting higher colony-forming unit counts (Scott et al., 1982). Estimating the

total bacterial count and diversity of bacteria in household kitchens can significantly contribute to enhancing hygiene protocols, especially in the aftermath of the COVID-19 pandemic. The purpose of undertaking this study was to investigate the prevalence of bacterial pathogens, their characterization and evaluate the efficacy of 70% ethanol on a variety of kitchen surfaces in 10 households in the Jaipur district. Further examination of bacterial pathogens and the impact of hygiene practices in post-pandemic settings could provide valuable insights into optimizing kitchen sanitation strategies.

## MATERIALS & METHODS

This study was undertaken in the kitchen areas of 10 households occupied by nuclear families. The study aimed to represent typical residential settings. A total of 50 samples (5 samples each household) were collected from a 50 cm<sup>2</sup> area of five kitchen settings: countertop, sink, window, stove, and floor from 10 households before and after disinfection with 70% alcohol. Sterile cotton swabs were used to collect samples. The duration of swabbing individual surfaces was uniform across kitchens at 10-15 seconds per location. The samples were immediately transferred to the laboratory at refrigerator conditions and were cultured within two hours to ensure minimal degradation. After the preparation of serial dilutions, the original sample and its dilutions were poured into plate count agar (PCA). All 50 samples were tested for the presence of five common foodborne bacterial pathogens by streaking them on selective media like Mac Conkey Agar, Mannitol Salt agar, Eosin methylene blue agar, Salmonella- Shigella (SS) agar. The control sample was streaked on nutrient agar (NA) without any surface contact. All the samples were incubated at 37 °C for 24 to 48 hours. Each experiment was repeated twice for consistency, and results were

averaged. After incubation, the bacterial colonies were counted using a colony counter. All the results were reported as cfu/ml. The cultural characterization was done based on colony morphology and Gram staining. Detailed species identification was performed using biochemical assays and microscopy.

## RESULT

Significant microbiological presence was found in all sampled regions prior to disinfection, according to the current investigation. Pre- and post-disinfection of kitchen surfaces with 70% alcohol resulted in an average bacterial count of 85 and 8.2, respectively (Table 1). Pre- and post-disinfection with 70% alcohol were associated with the greatest and lowest amounts of bacterial contamination, respectively. The stove had the lowest recorded number of bacteria, while the washbasin had the highest count. Microbial counts dramatically dropped after infection, demonstrating the effectiveness of 70% ethanol. Out of the 50 samples, 20 samples had *E. coli*, 14 samples contained *Staphylococcus* spp., 13 samples contained *Klebsiella pneumoniae*, 16 samples contained *Salmonella* spp., and 5 samples contained *Enterobacter* (Figure 1, 2 & 3). The kitchen countertop was home to the majority of *Klebsiella pneumoniae*, whereas the washbasin area had the highest concentration of *E. coli*, *Staphylococcus* species, and *Salmonella* species. On the floor, *Enterobacter* was at its highest. The findings indicated that one or more bacterial pathogens, including *Salmonella* spp., *Enterobacter*, *Staphylococcus* spp., *Escherichia coli*, and *Klebsiella pneumoniae*, were present in all of the samples. Bacterial pathogens were most common in the washbasin (22). They were also most common in the countertop (15), floor (13), stove (11), and window (7).



Figure 1



Figure 2

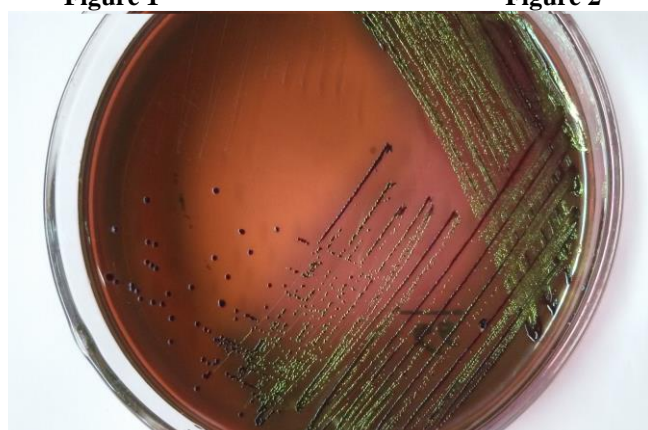


Figure 3

Figure 1 & 2- Selective isolation of *Staphylococcus aureus* and its Gram Staining  
Figure 3- *E. coli* showing green metallic sheen on EMB agar

**Table 1: Microbial Counts from Kitchen Surfaces of households before and after 70% Ethanol Disinfection**

Kitchen areas sampled	Bacterial count		Major bacteria found				
	Pre disinfection	Post disinfection	<i>E. coli</i>	<i>Staphylococcus</i> spp.	<i>Klebsiella pneumoniae</i>	<i>Salmonella</i> spp.	<i>Enterobacter</i>
Countertop (from all 10 households)	117	12	6	3	4	1	1
Sink (from all 10 households)	159	16	7	5	2	8	0
Floor (from all 10 households)	89	08	4	2	3	2	2
Window (from all 10 households)	40	03	1	1	2	2	1
Stove (from all 10 households)	20	02	2	3	2	3	1
Mean bacterial count	85	8.2					
Total			20	14	13	16	5

## DISCUSSION

Numerous studies underscore kitchens as hotspots for contamination, surpassing

bathrooms, cell phones, and specific toilet points (Marotta et al., 2018; Kramer et al., 2006). The effectiveness of 70% ethanol in

significantly reducing microbial counts is well-documented and corroborates existing antimicrobial research (Kampf et al., 2020). High levels of contamination are particularly noted in sink areas, highlighting them as critical points for cleaning and disinfection (William Rutala, 2023). Foodborne illnesses, such as *Salmonella*, commonly originate from contaminated kitchens, emphasizing the importance of rigorous monitoring and disinfection practices (Dufrenne et al., 2001; Todd et al., 2021). Effective household disinfection strategies should include regular use of agents like 70% ethanol, maintaining low humidity levels, maximizing exposure to sunlight, and proper management of kitchen textiles (Bloomfield et al., 2016; Scott et al., 2018). These measures are essential for controlling disease transmission, safeguarding kitchen hygiene, and reducing the risk of foodborne diseases.

## CONCLUSION

The kitchen plays a key role in transmitting pathogens to food and further in transmitting diseases to humans. The study's findings advocate for comprehensive hygiene practices, including environmental control and routine cleaning, to mitigate health risks from microbial exposure. Future studies should explore the long-term effectiveness of various disinfectants and their impact on different microbial species. The presence of potentially pathogenic microorganisms in commonly used kitchen areas underscores the importance of rigorous disinfection practices.

### Declaration by Authors

**Ethical Approval:** Not applicable

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**Conflict of Interest:** The authors declare no conflict of interest.

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