Isolation and identification of microbial strains from street food of Gomtinagar-Lucknow, UP, India

Aditi Srivastav[1], Chitranshu Pandey[2] and Pallavi Sharma[3*]
[1]Department of Biotechnology, Rama University, Kanpur, UP, India
[2]R & D Division, MRD Life sciences Pvt. Ltd. Lucknow, UP, India
[3]R & D Division, Somics Life sciences Pvt. Ltd. Bareilly, UP, India
pallsharma91@gmail.com

Abstract

Food-borne illnesses are increasingly being seen as a major public health concern and as a threat to the entire world's health. Utilizing tainted raw food components and particles, dirty water, unhygienic preparation methods, and infected containers all contributed to contamination. Investigating the microbial quality of samples of street food is the study's principal goal. A total of 50 samples of street cuisine from ten different vendors were randomly selected for the investigation. The usual microbiological procedure for isolating, counting, and identifying bacteria was employed to analyze the collected samples for the presence of bacteria. Salmonella spp. 5 (10%), E. coli 15 (30%), Staphylococcus aureus 6 (12%), Shigella spp. 5 (10%), Klebsiella spp. 9 (18%), and miscellaneous bacteria 10 (20%) were discovered in the samples that were collected. As a result, it is encouraged to apply sound risk analysis policies to give a scientific foundation to a variety of risk management options that Lucknow (Uttar Pradesh, India) may need to consider in order to ensure the health and safety of the general public.

Keywords: Street foods, Microbial contamination, Staphylococcus aureus, Shigella spp., Klebsiella spp.

Introduction

Street food vendors offer many benefits, but there have also been reports that their products pose major safety and health risks to both citizens and local handlers[1-4]. This is a result of their diversity, lack of food risk awareness and procedures, inadequate basic cleanliness, and low public understanding. The most significant potential health risks associated with food sold on the street include harmful emissions, use of unapproved artificial chemicals, and infection of parasites, pesticide residues, and microbiological pollutants[5-6]. The storage life of foods sold on the street is governed by the interactions of environmental, microbiological, and chemical factors, even while pH, temperature, food type, preparation techniques, processing, storage duration, and the quality of the water all affect food safety[7-10].

Street-vended foods are foods sold by street vendors that are ready to eat and drinks that have been prepared on the streets or at houses and are also sold mostly in street or any other public locations, such as schools, colleges, and universities, markets, and fairs[11,12]. These foods are frequently served from a local food stall or food cart, and then they are consumed on the streets without any further preparation. *Bacillus cereus, Salmonella spp., Staphylococcus aureus, Campylobacter jejuni, Shigella spp., Escherichia coli,* and *Clostridium perfringens* are some of the major pathogenic organisms connected with street-vended foodstuffs[13,14].

Food safety is a concern that affects all nations, not just developing ones[15]. Despite the development of food chain detection systems, affluent countries still have a considerable number of incidents of food borne illness and cholera[16,17].

WHO states that street vendors' foods give urban and rural poor customers the ability towards easily available, affordable, practical, and frequently nutritive food sources. Many street vendors in poor nations rely on selling meals on the streets to make a good living[18].

Methodology

Collection of samples: A total 50 different samples were collected randomly from ten street food vendors from different places in Gomti Nagar, Lucknow, Uttar Pradesh (India). The food samples were collected in sterilized polybags and taken to laboratory.

Isolation of bacteria using food sample: The collected samples were diluted in normal saline and then spread on nutrient agar medium. The nutrient agar plates were incubated at 37[o] for 48 hours. The obtained bacterial colonies were isolated on the basis of their morphological parameters and then sub cultured in nutrient agar media by continuous quadrant streaking[19].

Strain Identification through Biochemical tests: The pure cultures were streaked on Blood agar media and MacConkey agar media to identify the properties such as hemolysis and lactose fermentation. The recovered bacteria were examined under a microscope using Gram's staining to identify whether they were Gram-positive or Gram-negative bacteria. Salmonella spp. were identified using SS agar. Biochemical assays like Voges Proskauer, Methyl Red, IMViC-Indole, Urease, Citrate, Bile-esculin, Mannitol test, and Coagulase were then used to check the isolates for bacteria. Biochemical features and colony morphology were used to identify the species[20].

Effect of marketed antibiotics on isolates: The antibacterial activity of six different antibiotics against the isolates were investigated. The 50 ml solution of antibiotics (1 mg/ml) was poured into wells of nutrient agar plates after 20 ul isolate suspensions had been allowed to disseminate on the plates. The plates were kept at 37°C for 48 hours, and the zone of inhibition shows the antibiotics' inhibitory activity[21].

Statistical analysis: The percentage was used to determine the level of microbial contamination. The most common organism was discovered using statistics book by Zar Biostatistical Analysis.

Results and Discussion

It was unexpected to find microbes in the food items collected when studying samples of street food. As seen in figure 1, food-borne pathogens discovered in street food have been identified and named. Street foods have gained popularity over the past few years. Inadequate personal hygiene can facilitate the spread of harmful bacteria found in the environment and on people's hands to humans through eating. Street food has a unique flavor, is widely available, and is reasonably priced. Due to the fact that people are the primary source of infection, personal hygiene is also crucial for food safety. When handling and preparing street food, hygiene is absolutely essential. This study demonstrates that each sample is microbiologically unsafe for consumption. Figure-2 illustrates the bacteria that were detected from street food samples, including E. coli 15 (30%), Salmonella spp. 5 (10%), Shigella spp. 5 (10%), *Staphylococcus aureus* 6 (12%), *Klebsiella spp.* 9 (18%), and miscellaneous microbes 10 (20%).

The three most common organisms are Salmonella spp. (15%), E. coli (30%), and *Staphylococcus aureus* (10%). Strict public health regulations should be put in place to keep the problem under control. These delicacies from street vendors need to be maintained under strict supervision. Insects and rodents pick up infections from trash, sewage, and overflowing drains as they consume nutrients. The government should make the necessary steps to provide regular training and promote awareness of food management and personal cleanliness among street food vendors and customers.

To control the harmful effect of the isolates, the marketed antibiotics were screened for the effective activities and found that tetracycline was more effective then ampicillin and penicillin. Norfloxacin, ciprofloxacin and azithromycin were not showing any activity hence the isolates were resistive to these antibiotics as shown in Figure-4.
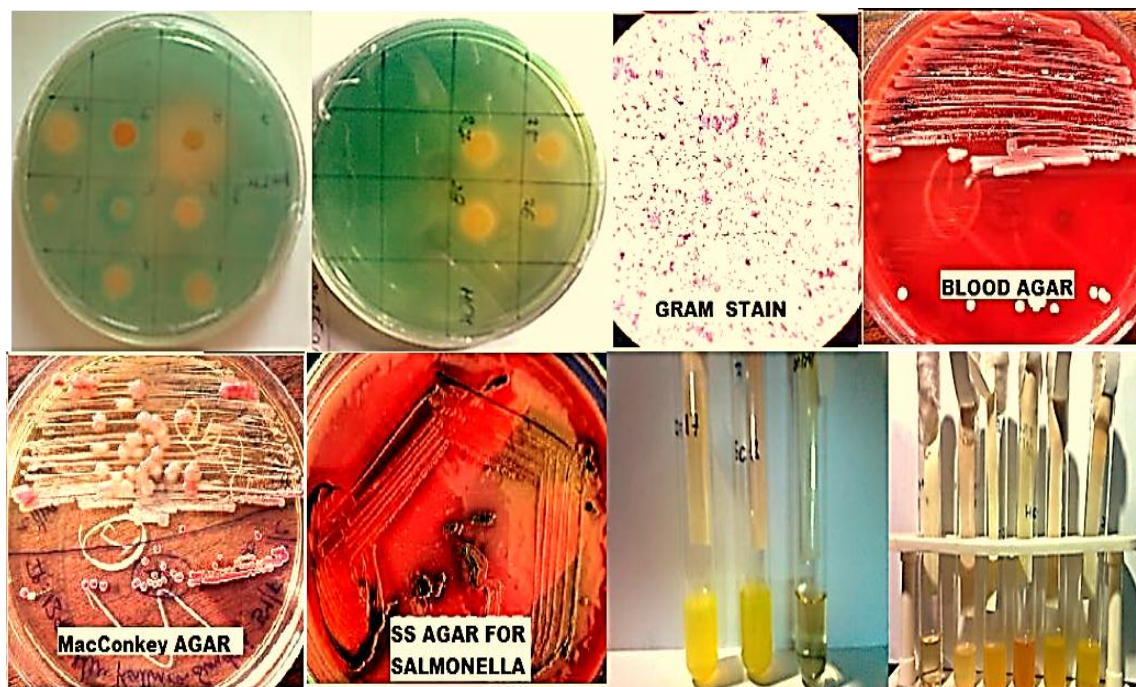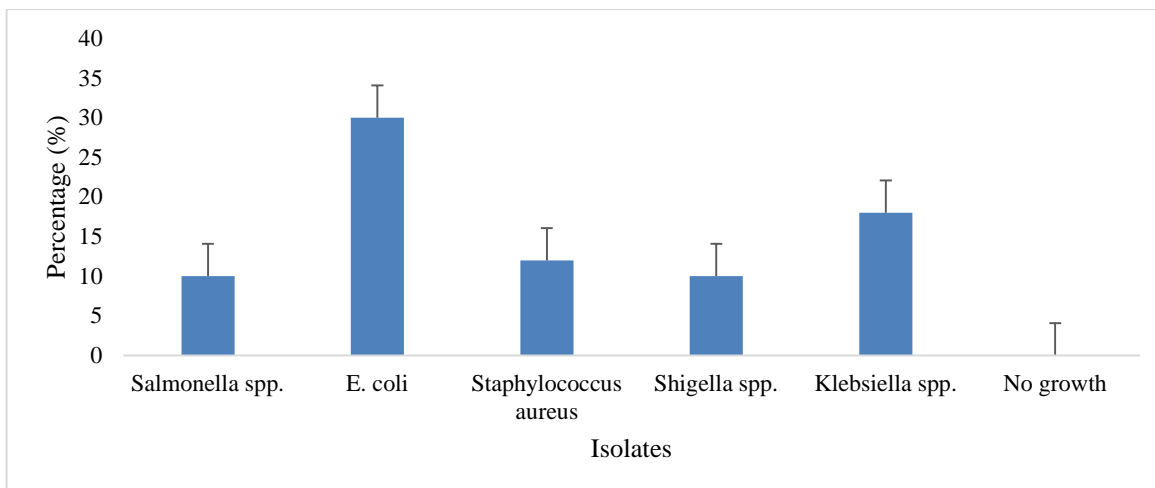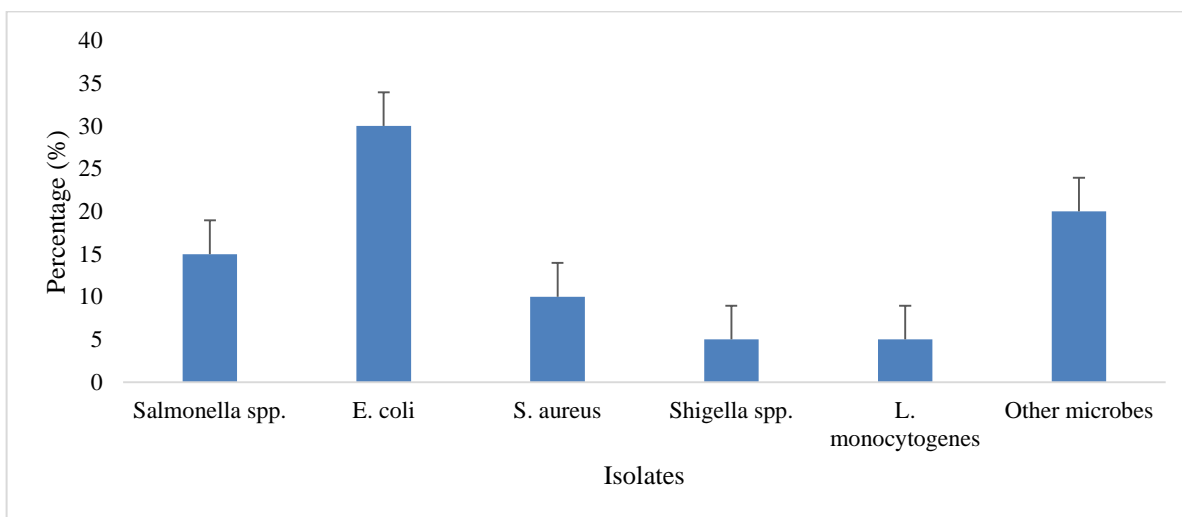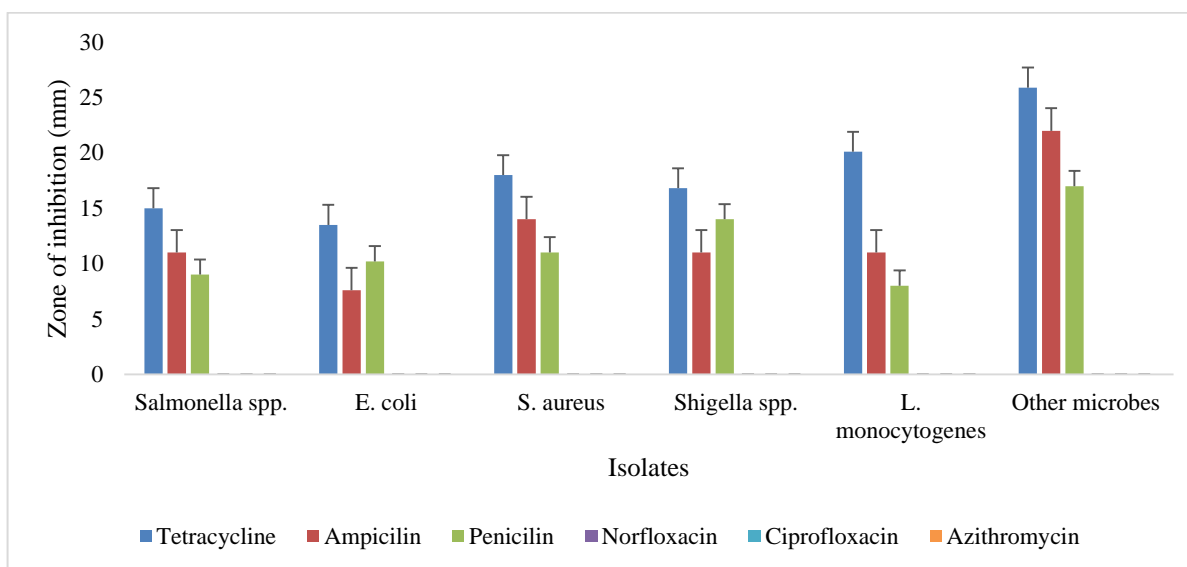

Figure-1: Bacterial isolates identification.

Figure-2: Graphical representation of percent identification of bacteria from street food.

Figure-3: Prevalence of isolates, isolated from street foods.

Figure-4: Antibiogram analysis of the antibiotics against the isolates.

Conclusion

The findings of the present investigation unequivocally showed that *Staphylococcus spp., Salmonella spp.,* and *E. coli* are present in street meals marketed in Lucknow. The presence of these microorganisms in food can have negative effects on consumers' overall health. Poor personal hygiene, careless handling techniques, prolonged storage of food at room temperature, and street vendors' ignorance of food safety and food borne illnesses are the factors that contribute to the contamination of street meals.

Vendors also lacked any training in food safety. Furthermore, a variety of antibiotic-resistant bacteria from fast food could serve as a vector for the spread of such strains in the neighbourhood and environment. Customers should therefore be informed of the negative effects of eating street cuisine.

References

1. Maloni, M. J., & Brown, M. E. (2006). Corporate social responsibility in the supply chain: an application in the food industry. *Journal of business ethics*, 68, 35-52.

2. Sharma, H. B., Vanapalli, K. R., Cheela, V. S., Ranjan, V. P., Jaglan, A. K., Dubey, B., ... & Bhattacharya, J. (2020). Challenges, opportunities, and innovations for effective solid waste management during and post COVID-19 pandemic. *Resources, conservation and recycling,* 162, 105052.

3. Roesel, K., & Grace, D. (2014). Food safety and informal markets: Animal products in sub-Saharan Africa. Routledge.

4. Khairuzzaman, M. D., Chowdhury, F. M., Zaman, S., Al Mamun, A., & Bari, M. L. (2014). Food safety challenges towards safe, healthy, and nutritious street foods in Bangladesh. *International journal of food science*, 2014(1), 483519.

5. Gallo, M., Ferrara, L., Calogero, A., Montesano, D., & Naviglio, D. (2020). Relationships between food and diseases: What to know to ensure food safety. *Food Research International*, 137, 109414.

6. Cairncross, S., & Feachem, R. (2018). Environmental health engineering in the tropics: Water, sanitation and disease control. *Routledge*.

7. Sperber, W. H. (2009). Introduction to the microbiological spoilage of foods and beverages. *Compendium of the microbiological spoilage of foods and beverages*, 1-40.

8. Rane, S. (2011). Street vended food in developing world: hazard analyses. *Indian journal of microbiology*, 51(1), 100-106.

9. Antwi-Agyei, P., Cairncross, S., Peasey, A., Price, V., Bruce, J., Baker, K., ... & Ensink, J. (2015). A farm to fork risk assessment for the use of wastewater in agriculture in Accra, Ghana. *PloS one*, 10(11), e0142346.

10. Sharma, S., Mulrey, L., Byrne, M., Jaiswal, A. K., & Jaiswal, S. (2022). Encapsulation of essential oils in nanocarriers for active food packaging. *Foods*, 11(15), 2337.

11. Cortese, R. D. M., Veiros, M. B., Feldman, C., & Cavalli, S. B. (2016). Food safety and hygiene practices of vendors during the chain of street food production in Florianopolis, Brazil: A cross-sectional study. *Food control*, 62, 178-186.

12. Khairuzzaman, M. D., Chowdhury, F. M., Zaman, S., Al Mamun, A., & Bari, M. L. (2014). Food safety challenges towards safe, healthy, and nutritious street foods in Bangladesh. *International journal of food science*, 2014(1), 483519.

13. Baidya, S., & Rahman, T. (2021). A Review on the prevalence and Detection of Bacterial contamination in Common Food and Associated Health Risk (Doctoral dissertation, Brac University).

14. Todd, E. C. (2017). Foodborne disease and food control in the Gulf States. Food Control, 73, 341-366.

15. Omojokun, J. (2013). Regulation and enforcement of legislation on food safety in Nigeria. *Mycotoxin and food safety in developing countries*, 10, 251-268.

16. Käferstein, F. K. (2003). Actions to reverse the upward curve of foodborne illness. *Food control,* 14(2), 101-109.

17. Grace, D. (2015). Food safety in low and middle income countries. *International journal of environmental research and public health*, 12(9), 10490-10507.

18. Etzold, B. (2015). Selling in insecurity—Living with violence. Street Vending In The Neoliberal City: A Global Perspective on the Practices and Policies of a Marginalized Economy, New York: Berghahn Books.

19. Edalati, E., Saneei, B., Alizadeh, M., Hosseini, S. S., Bialvaei, A. Z., & Taheri, K. (2019). Isolation of probiotic bacteria from raw camel's milk and their antagonistic effects on two bacteria causing food poisoning. *New microbes and new infections*, 27, 64-68.

20. Talaiekhozani, A. (2013). Guidelines for quick application of biochemical tests to identify unknown bacteria. *Account of Biotechnology Research*.

21. Sharma, P., Singh, V., Maurya, S. K., Kamal, M. A., & Poddar, N. K. (2021). Antimicrobial and antifungal properties of leaves to root extracts and saponin fractions of Chlorophytum borivilianum. *Current Bioactive Compounds*, 17(6), 59-68.