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Microbial and Qualitative Analysis of Panipuri Water in Selected Areas of Pune

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ABSTRACT

Street-vended foods are popular because they are affordable and easily available. Panipuri is one of the most consumed street foods in India, but the quality of the flavoured water used in its preparation is often doubtful. The present study was carried out to investigate the microbial and physicochemical quality of panipuri water collected from different areas of Pune, Maharashtra. We have collected 30 samples from street vendors are analyzed for Total Plate Count (TPC), coliform, Escherichia Coli. The pH, Salinity, and color were also recorded. Standard microbiological methods used for microbial analysis.

We found 64% of samples showing TNTC values for TPC, Coliforms were present in 50% of samples and E. Coli were detected in 36% of samples which is beyond FSSAI limit indicating poor hygiene and possible fecal contamination. The pH of the samples ranged from 2.0 to 6.0, while salinity was low in most samples. Color varied depending on the ingredients used. Based on these findings we concluded that a considerable number of panipuri water samples were microbiologically unsafe for consumption. Therefore, the study highlights the need for improved hygiene practices, use of potable water and regular monitoring of street-vended foods to ensure food safety and public health.

Keywords: (Panipuri Water, Microbial Contamination, TPC, E. Coli, Physicochemical Analysis, Pune City)

INTRODUCTION

Street foods are widely consumed across the world especially in developing countries due to their affordability, easy accessibility, palatability and convenience. In India street foods play an important role in daily life and urban food culture. Among the various street foods, panipuri (also known as golgappa or puchka) is one of the most consumed ready to eat snacks. The flavoured water used in its preparation is prepared using water, tamarind, mint, spices and other ingredients. Since this water is served without any heat treatment and is frequently handled during preparation and serving, it is highly susceptible to microbial contamination (World Health Organisation,2022).

The microbial quality of street-vended foods is a major concern. Contamination can occur due to the use of unsafe water, poor personal hygiene of food handlers, exposure to dirt and insects, and improper storage conditions. Consumption of contaminated food or water may lead to foodborne illnesses such as diarrhea, vomiting, typhoid, cholera and other gastrointestinal infections. Therefore, regular monitoring of the microbial quality of street foods is essential to protect consumer health (FAO & WHO, 2022).

Microbial indicators such as Total Plate Count (TPC), coliform bacteria, and Escherichia coli are widely used to assess the hygienic quality and safety of food and water. TPC provides information about the

overall bacterial load present in a sample, while the presence of coliforms indicates poor sanitary conditions. Escherichia coli is considered an important indicator of fecal contamination and suggests that harmful microorganisms may also be present. According to the World Health Organization, E. coli should not be detected in drinking water intended for human consumption (WHO, 2022).

Several studies conducted in India and other countries have reported high microbial contamination in panipuri and other street-vended foods. Researchers have detected high bacterial counts, coliform bacteria, and E. coli in samples collected from different vending locations, indicating poor hygiene practices and the use of contaminated water during food preparation (Jamadar et al., 2024; Bisht et al., 2024). These findings highlight the importance of improving food safety practices among street food vendors.

Along with microbial analysis, physicochemical characteristics such as pH, salinity, and color provide useful information about the quality of panipuri water. The pH of water can influence microbial growth and survival, whereas salinity reflects the concentration of dissolved salts. Color may indicate changes in ingredients, storage conditions, or possible contamination. The combined evaluation of both microbial and physicochemical parameters provides a more complete assessment of food safety.

Several previous studies have investigated the microbial quality of street foods in different regions of India and also in other countries but limited information is available about the quality of panipuri water sold in Pune. With the increasing consumption of street foods and the potential health risks associated with contaminated water, there is a need to generate local scientific data that can support food safety awareness and regulatory measures.

Therefore, the present study was undertaken to evaluate the microbial and physicochemical quality of panipuri water collected from selected areas of Pune. This study included assessment of Total Plate Count, coliform bacteria, Escherichia coli, pH, salinity, and color to determine the overall safety and hygienic quality of the samples.

METHODOLOGY

Study Area

This study was conducted at the SNDT College of Home Science, Pune, Maharashtra during 2026.

Sample Collection

About 30 panipuri water samples were randomly collected from street vendors in the top 5 local areas of Pune City. These samples were collected aseptically in sterile glass bottles to
prevent their contact with any other source that can contaminate the samples. Each sample was properly labelled transported under refrigerated temperature and analysed within a few hours.

Procedure

Sample preparation

Each sample was serially diluted using sterile Phosphate Buffer Saline (PBS) before analysis (1ml of sample in 9 ml of PBS).

To detect the total viable bacterial growth and coliform and E.coli count of the panipuri water samples, microbial analysis of the panipuri water sample was performed. For bacterial analysis, to enumerate the "total" or viable bacterial growth of the panipuri water samples Plate Count Agar (PCA) has been used, and for enumeration of coliforms in panipuri water samples, Eosin Methylene Blue (EMB)agar was used. The total plate count technique gives the number of viable organisms present in a particular sample. We followed a spread plate method according to the FSSAI manual. For bacterial analysis of panipuri water, we used PCA and EMB agar media.

TPC Enumeration

The TPC was determined using the spread plate method on PCA agar. Required weighed amount of media is dissolved in distilled water and autoclaved it to 121 °C for 15 minutes and cool it.10- 15 ml of agar was poured into each Petri plate. After that, 0.1 ml of diluted sample was evenly spread using the spread plate method and incubated at 37 °C for 24 hours. After incubation, visible colonies were counted and result expressed as CFU/ml.

The same procedure was followed for determination of coliforms and E.coli. the only difference was the growth of pink colonies on EMB agar considered as Coliforms and colonies showing metallic green sheen color considered as presumptive E.coli.

For further confirmation of E.coli, IMVIC biochemical test was performed.

Physicochemical Analysis

The physicochemical quality of panipuri water was evaluated by determining pH, salinity and color. The pH of each sample was measured using pH indicator strips. Salinity was estimated by using Mohr's titration method and color was assessed by visual inspection.

RESULT

Microbial Analysis of panipuri water

Table 1.0 Microbial Analysis of Panipuri Water

Sample	TPC (CFU/ml)	E. Coli (CFU/ml)	Coliform (CFU/ml)
S1	1.95×10^6	4.9×10^4	Absent
S2	TNTC	Absent	1.3×10^3
S3	7.8×10^2	Absent	Absent
S4	7.35×10^4	Absent	Absent
S5	1.83×10^3	1.0×10^2	TNTC
S6	1.02×10^4	Absent	Absent
S7	5.4×10^2	Absent	Absent
S8	TNTC	Absent	Absent
S9	TNTC	7.75×10^2	2.34×10^3
S10	8.25×10^2	1×10^1	3×10^1
S11	2.2×10^3	1×10^1	3×10^1
S12	TNTC	Absent	1.5×10^2
S13	1.9×10^2	Absent	Absent
S14	1.15×10^2	Absent	Absent
S15	TNTC	Absent	Absent
S16	TNTC	Absent	9.0×10^2
S17	TNTC	Absent	1.0×10^2
S18	TNTC	Absent	Absent
S19	TNTC	1.0×10^2	1.2×10^3
S20	TNTC	Absent	Absent
S21	TNTC	Absent	1.1×10^4
S22	TNTC	1.2×10^3	2.8×10^3
S23	TNTC	3.0×10^2	2.1×10^3

S24	TNTC	Absent	TNTC
S25	TNTC	4.0 X 10^2	9.4 X 10^4
S26	TNTC	Absent	Absent
S27	TNTC	4.0 X 10^3	5.0 X 10^1
S28	3.0 X 10^3	Absent	Absent
S29	TNTC	Absent	Absent
S30	1.9 X 10^3	Absent	Absent

From a total of 30 panipuri water samples collected from street vendors, we found contamination in 19(64%) samples. But according to FSSAI microbial standards, the standard aerobic plate count is 1 X10^3/g. In this analysis, we found out that the CFU/g count is beyond the standard. That is why we can consider the street's panipuri water as harmful in considering foodborne illness.

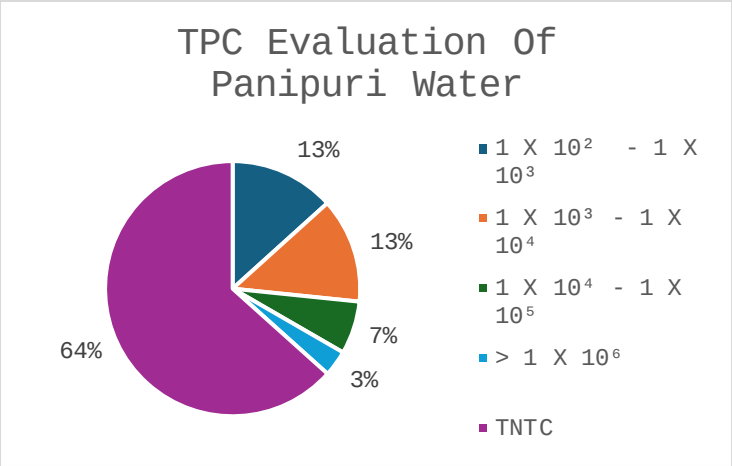


Chart 1. TPC Evaluation of Panipuri Water

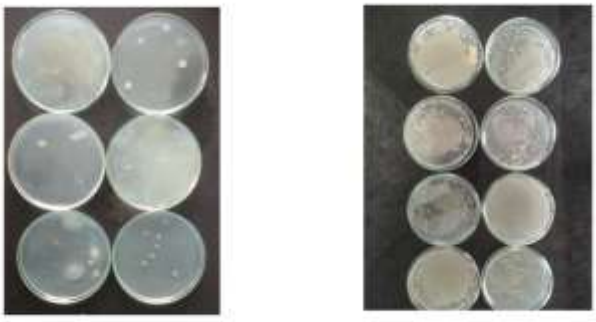


Figure 1. Growth of Colonies on Plate Count Agar

Coliforms were detected in15 (50%) of samples. In 30 panipuri water samples collected from street vendors, we found the presence of coliform in 15 (50%) samples indicates unhygienic conditions. In this analysis, we found that the CFU/ml count is beyond the standard. That is why we can consider the street's panipuri water is harmful as considering food born illness.

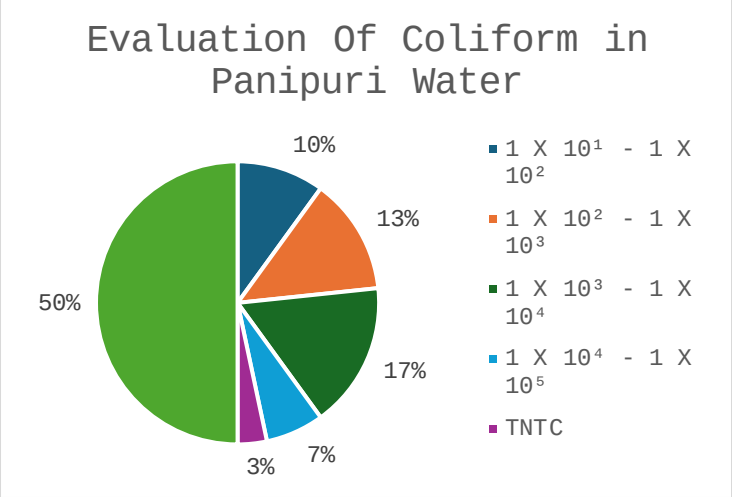


Chart 2. Coliform Evaluation of Panipuri water



Figure 2. Coliform Colonies on EMB Agar Showing Pink Colonies

We also detected E.coli in11 (36%) samples out of 30samples. We have done IMVIC test for confirmation that showed result (++--) in this pattern. As per the FSSAI standards, E.coli should be absent in potable water. Therefore, we can consider that panipuri water is harmful for consumers.

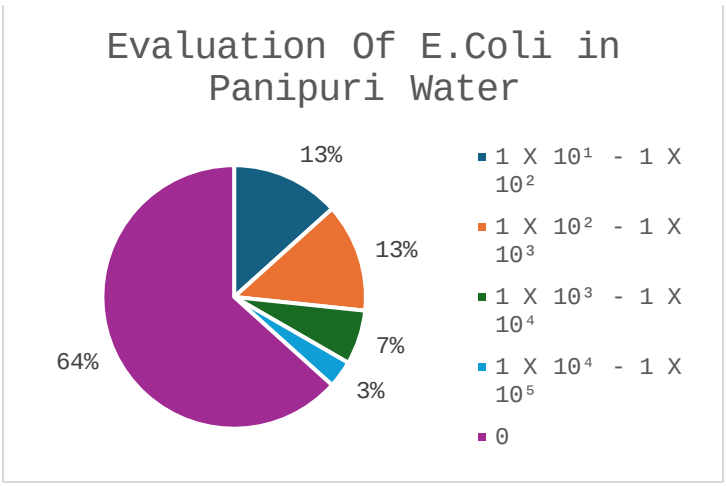


Chart 3. E.coli Evaluation of Panipuri Water

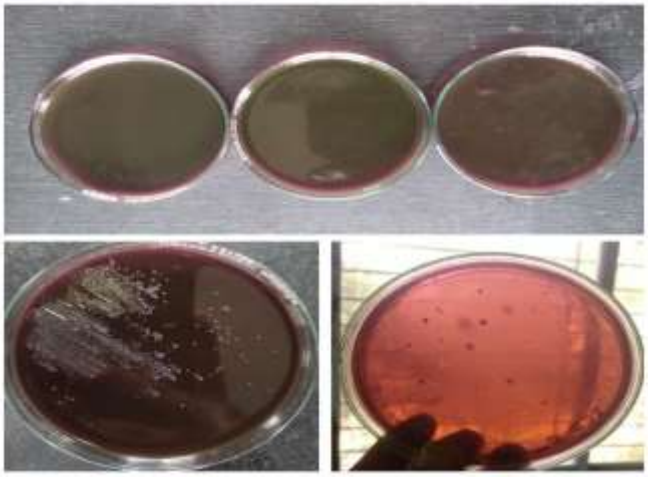


Figure 3. E. coli Colonies on EMB Agar Showing Metallic Sheen

Physicochemical analysis of panipuri water

Table 2.0 Physicochemical Analysis of Panipuri Water

Sample (S)	pH	Salinity (g%)	Color
S1	4.0	0.0239	Green
S2	2.0	No Salinity	Light green
S3	2.0	No Salinity	Light yellow
S4	2.0	No Salinity	Green
S5	2.0	No Salinity	Brownish
S6	2.0	No Salinity	Light green
S7	2.0	No Salinity	Green
S8	2.0	No Salinity	Light yellow
S9	4.0	No Salinity	Light green
S10	4.0	No Salinity	Green
S11	4.0	No Salinity	Light yellow
S12	2.0	No Salinity	Light green
S13	2.0	No Salinity	Green
S14	2.0	No Salinity	Light yellow
S15	2.0	No Salinity	Brownish
S16	2.0	No Salinity	Light yellow
S17	2.0	No Salinity	Green
S18	4.0	No Salinity	Light green
S19	4.0	No Salinity	Light yellow
S20	2.0	No Salinity	Green
S21	2.0	No Salinity	Light green
S22	4.0	No Salinity	Light yellow
S23	4.0	No Salinity	Green
S24	4.0	No Salinity	Green
S25	2.0	No Salinity	Light green

S26	2.0	No Salinity	Light green
S27	6.0	No Salinity	Pale yellow green
S28	2.0	No Salinity	Light yellow
S29	4.0	No Salinity	Brownish
S30	4.0	No Salinity	Light green

pH

Bacteria need optimum pH for their rapid growth. In this analysis of 30 panipuri water samples, 18(61%) samples pH was 2, 11(36%) samples had a pH of 4, and 1(3%) sample had a pH of 6.

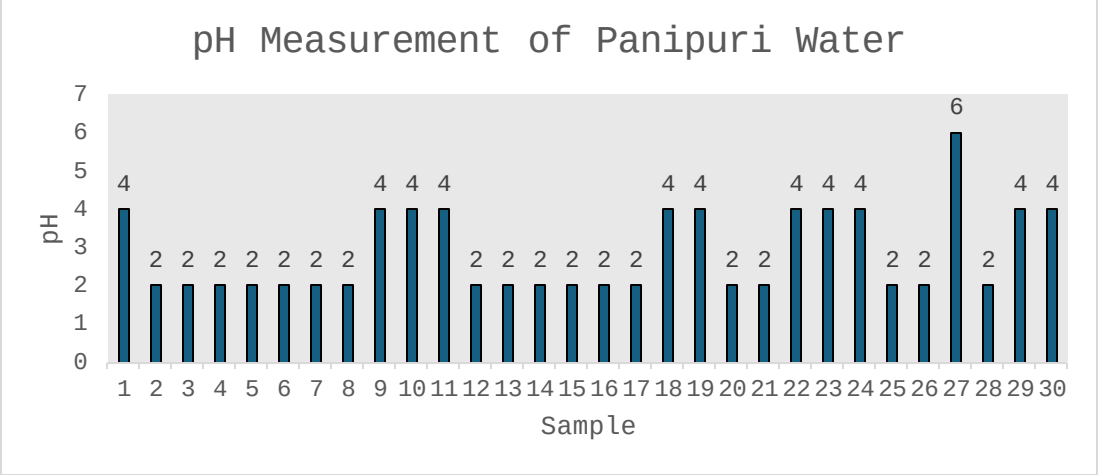


Chart 4. pH Measurement of Panipuri Water

Salinity

The following table summarises the salinity percent of collected samples of panipuri water samples. We have collected 30 samples, of which 29(97%) samples had negligible salinity, whereas 1(3%) sample had a salinity of 0.0239g%.

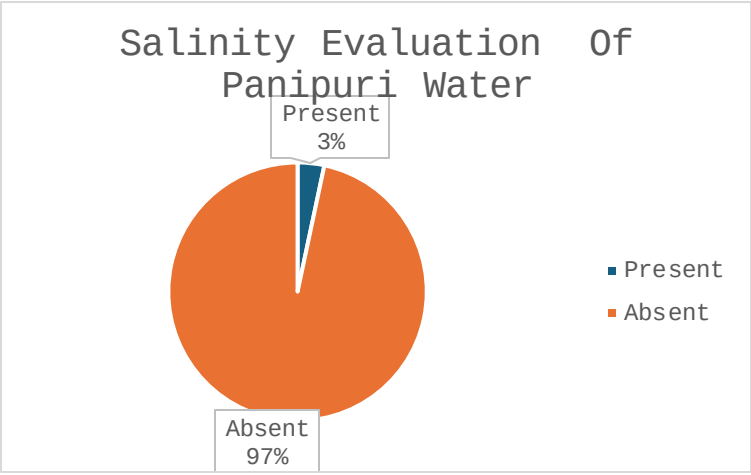


Chart 5. Salinity Evaluation of Panipuri Water

Color

Among these samples color was varied because use of different ingredients in its preparation. 9 (31%) samples had light green, 8 (28%) samples had green color ,8 (28%) samples had light yellow color,3 (10%) samples had brownish color,1(3%) sample had pale yellow green color.

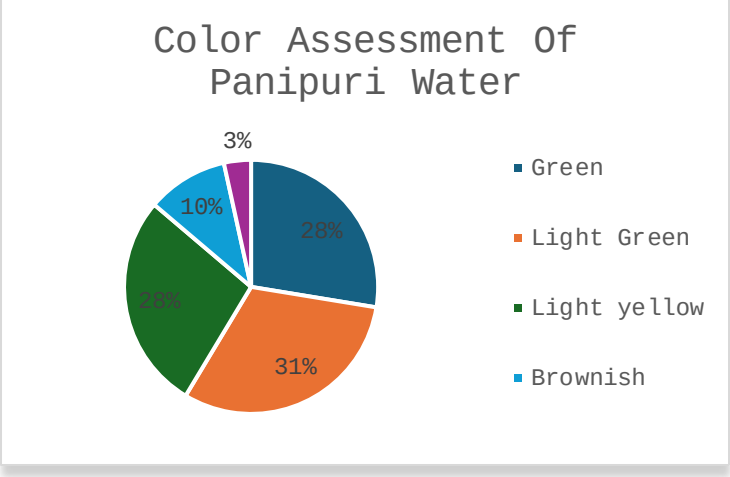


Chart 6. Color Assessment of Panipuri Water

DISCUSSION

As we know, street foods are widely consumed because of their affordability and easy accessibility; however, their microbial safety remains a major challenge. Panipuri water get contaminated possibly due to the use of unsafe water, poor personal hygiene of food handlers, exposure to dust& dirt, and improper storage conditions. Therefore, the present study evaluated the microbial and physicochemical quality of panipuri water.

The present research work was, therefore, undertaken to test for different parameters such as the Total microbial count, coliform count, E. coli, pH, and salinity from the panipuri water samples collected from street vendors of different places in Pune City, Maharashtra.

We found microbial growth in 19(64%) samples. According to FSSAI microbial standards, the standard aerobic plate count is 1 X10^3/ml. In this analysis, found out that the CFU/ml count is beyond the FSSAI standard. Coliforms and E.coli should not be present in potable water however in this study we got these bacteria. In the physical properties of the sample, we observed all the samples had acidic pH still there was high bacterial load. Salinity was negligible in most of the samples. color varied depending on ingredients.

CONCLUSION

We have studied the microbial and physicochemical profile of street food panipuri water which is unprocessed, and it has raw materials like green chilli, coriander leaves, mint leaves, ginger, garlic and some other spices. After this study conclusion can be made that microbial count is beyond the FSSAI limits in panipuri water samples in certain areas of Pune city. Physicochemical analysis revealed that though the pH was acidic still there was high bacterial load and salinity was negligible, color varied on ingredients. This study concludes that the panipuri water samples analyzed were microbiologically unsafe as per FSSAI standards. Hence, from this study we can say that the panipuri water in certain areas of Pune

city is highly contaminated with pathogenic bacteria like coliforms and E. coli. Study highlights the need for use of safe water, improved hygiene practices, and strict regulatory monitoring of street food vendors.

REFERENCE

1. Anjum, A. (2015). Isolation of Shiga toxin producing Escherichia coli O157:H7 from street food and raw vegetables in Dhaka city (Master's thesis). BRAC University.
2. Bisht, R. (2024). Bacteriological identification of Salmonella in street vended food panipuri in Bhopal Awadhpuri region. International Journal of Innovative Research in Technology and Science, 12(2), 58–63.
3. Castro-Rosas, J., Cerna-Cortés, J. F., Méndez-Reyes, E., López-Hernández, D., Gómez-Aldapa, C. A., & Estrada-García, T. (2012). Presence of faecal coliforms and Escherichia coli in ready-to-eat salads. International Journal of Food Microbiology, 156(2), 176–180. https://doi.org/10.1016/j.ijfoodmicro.2012.03.025
1. 4. Chumber, S. K., Kaushik, K., & Savy, S. (2007). Bacteriological analysis of street foods in Pune. Indian Journal of Public Health, 51(2), 114–116.
4. Edberg, S. C., Rice, E. W., Karlin, R. J., & Allen, M. J. (2000). Escherichia coli: The best biological drinking water indicator. Journal of Applied Microbiology, 88, 106S116S.
5. Ekici, K., & Dümen, E. (2019). Escherichia coli and food safety. In E. M. T. El-Sayed (Ed.), Escherichia coli – Recent Advances. IntechOpen. https://doi.org/10.5772/intechopen.82045
6. Fusaro, C., et al. (2025). Molecular identification of Escherichia coli isolated from street foods. Microbiology Research, 16(12), 253. https://doi.org/10.3390/microbiolres16120253
7. Gautam, K., et al. (2022). Microbiological assessment of selected street-vended foods in Kathmandu Valley. Public Health Perspective Journal, 7(1).
8. Islam, M. S., et al. (2015). Microbiological quality of street-vended beverages in Bangladesh. International Food Research Journal, 22(2), 567–572.
9. Jamadar, D., Patil, S. S., & Kulkarni, R. (2023). Microbial assessment of street vended panipuri from different zones of Bidar, Karnataka. Journal of Experimental Zoology India, 25(2), 1807–1813.
10. Khadka, S., Shrestha, S., & Pandey, S. (2018). Bacterial contamination in street-vended panipuri. International Journal of Applied Sciences and Biotechnology, 6(3), 247–252.
11. Malabadi, R. B., et al. (2024). Pathogenic Escherichia coli food-borne outbreak. Magna Scientia Advanced Research and Reviews, 10(1), 52–85.
12. Marwaha, P., Tiwari, S., & Pathak, S. (2025). Bacterial identification in street foods. International Journal of Plant and Environment, 11(3), 623–629.
13. Muinde, O. K., & Kuria, E. (2005). Hygienic practices of street food vendors. African Journal of Food, Agriculture, Nutrition and Development, 5(1), 1–13.
14. Nisa, I. F., et al. (2019). Analysis of Escherichia coli contamination in street food. Public Health Perspective Journal, 4(1).
15. Ozdemir, S., et al. (2022). Microbiological quality of street-vended foods in Kathmandu Valley.
16. Rane, S. (2011). Street vended food hazards. Indian Journal of Microbiology, 51(1), 100–106.
17. Rohmah, J., et al. (2018). Hygiene and sanitation related to E. coli contamination. IOP Conference Series, 420, 012143.
18. Singh, R., Verma, S., & Gupta, A. (2020). Microbiological quality assessment of streetvended foods. International Journal of Current Microbiology and Applied Sciences, 9(5), 1234–1242.

19. Sivakumar, M., et al. (2020). ESBL-producing E. coli in street foods. Journal of Food Science and Technology, 58(4), 1247–1261.
20. Suthar, R. M., et al. (2017). Microbiological quality of water samples. International Journal of Current Microbiology and Applied Sciences, 6(7), 1234–1242.
21. Tambekar, D. H., et al. (2011). Bacteriological quality of street vended panipuri. Bioscience Discovery, 2(3), 350–354.
22. Teegala, V., et al. (2020). Microbiological quality of panipuri. Journal of Food Safety and Hygiene, 6(3), 127–132.
23. Tuladhar, R., & Singh, A. (2015). Bacterial analysis of street food in Kathmandu. Journal of Natural History Museum, 26, 1–9.
24. World Health Organization (WHO). (2017). Guidelines for drinking-water quality (4th ed.). WHO.
25. Yadav, N. P., et al. (2019). Bacterial contamination of street vended pani puri. Tribhuvan University Journal of Microbiology, 6, 63–67.
26. Zurita, J., et al. (2020). Multidrug-resistant E. coli in street foods. Letters in Applied Microbiology, 70(3), 203–209.

BIBLIOGRAPHY

1. Bhattacharya, S. (2010). Microbiological quality of street-vended Indian chaats. Journal of Biological Sciences, 10(3), 255–260.
2. Galli, L., et al. (2016). Escherichia coli in food products. Springer.
3. Herawati, C., et al. (2023). Hygiene and behavior of food handlers. Journal of Pure and Applied Microbiology, 17(4), 2098–2103.
4. Kandasamy, R. (2022). Biotyping of avian pathogenic E. coli. Journal of Veterinary and Animal Sciences, 53(1), 45–52.
5. Mehta, H. D., et al. (2020). Hygiene of street food panipuri. Indian Journal of Pure & Applied Biosciences, 8(4), 313–317.
6. Mishra, R. K. (2018). Bacteriological quality of panipuri. Asian Journal of Pharmaceutics, 12(1).
7. Mustika, Y. R., et al. (2023). Multidrug-resistant E. coli in cattle. Journal of Advanced Veterinary and Animal Research, 10(1), 55–63.
8. Prakash, R., & Deepalakshmi, K. (2016). Physicochemical and microbiological water quality. International Journal of Applied Research, 2(6), 123–127.
9. Raghupathi, C., et al. (2022). Microbial assessment of panipuri. Journal of Experimental Zoology India, 25(2), 1807–1813.
10. Wang, Y., et al. (2013). Monitoring E. coli using biosensor. Food Chemistry, 141(4), 3307–3313.