|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 5, Issue 6; June: 2021; Page No. 230-233

Isolation and identification of bacterial pathogens associated with foodborne illnesses in stool samples: A prospective study

Vietla Sreeramulu[1], T Jaya Chandra[2]

[1]Associate Professor, Department of Medical Gastroenterology, GSL Medical College, Rajahmundry

[2]Professor, Department of Microbiology, GSL Medical College, Rajahmundry

Article Info: Received 28 April 2021; Accepted 17 June 2021
DOI: https://doi.org/10.32553/ijmbs.v5i6.2367
Corresponding author: Dr T Jaya Chandra
Conflict of interest: No conflict of interest.

Abstract

Introduction: Foodborne illnesses significantly impact public health, necessitating the isolation and identification of bacterial pathogens such as Salmonella, Escherichia coli, and Staphylococcus aureus. This study aims to isolate and identify bacteria from stool samples of individuals exhibiting food poisoning symptoms, enhancing understanding and prevention of these infections.

Methods: This prospective study, conducted at GSL Medical College from August to September 2021, involved individuals over 18 years with food poisoning symptoms. Stool samples were collected, cultured on selective media, and analyzed for bacterial identification using Gram staining and biochemical tests, followed by statistical analysis of prevalence and symptoms.

Results: The study included 100 participants, with 52% male and a majority (40%) aged 31–45 years. Abdominal pain (80%) and diarrhea (75%) were the most common symptoms. The predominant isolates were E. coli (30%) and Salmonella spp. (25%), with symptom correlations revealing distinct clinical presentations among the pathogens.

Conclusion: This study underscores the significant role of pathogens in foodborne illnesses, particularly E. coli and Salmonella spp. The correlation between these pathogens and symptoms highlights diverse clinical presentations, emphasizing the need for effective food safety measures and public health interventions to mitigate the impact of foodborne infections on community health.

Introduction

Foodborne illnesses pose a significant public health challenge worldwide, often resulting in severe morbidity and mortality. The isolation and identification of bacterial pathogens responsible for food poisoning are essential for understanding the epidemiology of these illnesses and developing preventive measures. [1] Among the primary bacterial culprits, Salmonella, *Escherichia coli*, *Staphylococcus aureus*, and *Listeria monocytogenes* are recognized globally for their roles in contaminating various food products, causing conditions ranging from mild gastrointestinal distress to life-threatening infections. [2]

The detection of these bacteria relies on advanced microbiological techniques, including culture-based methods, molecular identification, and serotyping. Traditional culture techniques allow for the accurate identification of bacterial species and strains, aiding in outbreak investigations and food safety assessments. [3] Moreover, recent advancements, such as polymerase chain reaction (PCR) and next-generation sequencing, have enhanced the detection sensitivity and specificity

for isolating foodborne pathogens in complex food matrices. [4, 5]

The rising incidence of antibiotic resistance among foodborne pathogens further underscores the importance of identifying and characterizing these organisms in food sources, enabling public health authorities to implement timely and targeted interventions. [5] With this a study was conducted to isolate and identify bacteria associated with foodborne illnesses in the stool sample of the individuals with signs and symptoms of food poisoning.

Methods:

It was prospective research conducted in the department of Microbiology, GSL Medical College. Study was conducted from January to May 2021. Study protocol was approved by the Institutional ethics committee. An informed written consent was taken from the study members.

Individuals of both gender, aged >18 years with signs and symptoms of food poisoning such as abdominal pain, vomiting, diarrhoea etc were included in the research. Non cooperative individuals and those in unconscious state were not considered in the research.

Stool samples were collected from the study members. Each sample was collected in sterile containers and transported to the laboratory for analysis within two hours of collection to maintain viability. Upon arrival at the laboratory, each stool sample was subjected to a macroscopic examination for consistency, color, and presence of blood or mucus. A portion of each sample (approximately 1 g) was then mixed with 9 mL of sterile saline solution to create a 1:10 dilution. This mixture was vortexed to ensure homogenization.

Specimen was cultured in different media and after incubation, the growth was identified by gram stain and battery of biochemical tests asp per Chandra TJ et al. [6] report. The diluted stool samples were inoculated onto selective media specific for various foodborne pathogens. Different culture media namely, Xylose Lysine Deoxycholate (XLD) agar, MacConkey agar, Cetrimide agar were used. Plates were incubated at 35-37^{0}C for 24-48 hours under appropriate atmospheric conditions.

The prevalence of each bacterial species was recorded, and statistical analysis was performed to evaluate the association between the identified pathogens and clinical symptoms. Descriptive statistics were utilized to summarize the findings, and results were interpreted in the context of existing literature on foodborne illnesses.

Results:

Total 100 members were included, 52% were male. Majority (40%) were in 31 – 45 years group. Abdominal pain (80%) was the leading clinical symptom followed by diarrhoea (75%). In this research, Esch.coli was the leading (30%) isolate followed by Salmonella spp (25%), Staph. aureus (20%), Shigella spp (15%) and Pseud. aeruginosa (10%). When pathogens and symptoms were correlated, *Escherichia coli* and Salmonella spp. exhibited high percentages of abdominal pain and diarrhea, while Shigella spp. showed significant correlations with vomiting and fever, highlighting the varied clinical presentations of these pathogens.

Discussion:

In this study, a total of 100 individuals were included, with a notable male predominance at 52%. The age distribution revealed that the majority (40%) of participants fell within the 31 to 45 years age group, highlighting a critical demographic affected by foodborne illnesses. This finding aligns with previous research indicating that adults, particularly those in their thirties and forties, are frequently affected by foodborne pathogens due to dietary choices and occupational exposures. [7, 8]

Abdominal pain was the most prevalent clinical symptom, reported by 80% of participants, closely followed by diarrhea, which was observed in 75% of the cases. The high incidence of abdominal pain and diarrhea in this cohort is consistent with the symptomatology associated with common foodborne pathogens, such as Salmonella and *Escherichia coli*, which are known to cause gastroenteritis. [9] These symptoms often result from the inflammatory response elicited by

bacterial toxins or the direct invasion of intestinal mucosa, leading to gastrointestinal distress. Understanding the clinical presentation of foodborne illnesses is crucial for timely diagnosis and treatment. The data from this study emphasize the importance of monitoring food safety and public health initiatives, particularly targeting the adult population, to mitigate the risks associated with foodborne pathogens. [10, 11]

In this research, *Escherichia coli* emerged as the predominant isolate, accounting for 30% of the total bacterial pathogens identified. This finding is consistent with numerous studies highlighting E. coli as a major contributor to foodborne illnesses globally. It is often implicated in outbreaks linked to contaminated food and water sources, particularly in regions with inadequate sanitation and hygiene practices. [12]

Following E. coli, Salmonella spp. constituted 25% of the isolates. Salmonella remains one of the most frequently reported foodborne pathogens, commonly associated with undercooked poultry, eggs, and dairy products. Its prevalence in this study emphasizes the ongoing public health challenge posed by this pathogen and the need for stringent food safety measures to prevent infections. [13]

Additionally, *Staphylococcus aureus*, identified in 20% of the samples, is known for its ability to produce heat-stable enterotoxins, leading to food poisoning outbreaks linked to improperly handled food items. Similarly, Shigella spp. (15%) and *Pseudomonas aeruginosa* (10%) were also isolated, though less frequently. Shigella is recognized for its low infectious dose and ability to cause severe gastrointestinal distress, while *Pseudomonas aeruginosa* is more commonly associated with nosocomial infections but can also be involved in foodborne illnesses. [12, 14]

In this study, the correlation between specific pathogens and clinical symptoms revealed distinct patterns associated with foodborne illnesses. Notably, *Escherichia coli* and Salmonella spp. were linked to high percentages of abdominal pain and diarrhea, which are hallmark symptoms of gastroenteritis caused by these pathogens. The mechanism of abdominal pain in such infections is often attributed to the inflammatory response elicited by bacterial toxins or direct damage to the intestinal mucosa. [12] The association of Shigella spp. with vomiting and fever underscores its pathogenic potential and the severity of illness it can cause. Shigella infections are characterized by a low infectious dose and can lead to dysentery, presenting with bloody diarrhea, fever, and severe abdominal cramps. The ability of Shigella to invade the intestinal epithelium and induce inflammation contributes to its symptomatology. [12, 15]

These findings align with previous research that emphasizes the diverse clinical presentations associated with different foodborne pathogens. [15] Understanding the symptom profiles related to specific bacteria is crucial for clinicians to make timely diagnoses and implement appropriate treatment strategies. Moreover, this knowledge is essential for public health efforts aimed at preventing foodborne illnesses, highlighting the need for effective food safety practices and community education on hygiene to mitigate the risks of such infections.

In conclusion, this study highlights the significant role of various pathogens in foodborne illnesses, with *Escherichia coli* and *Salmonella spp.* being the most prevalent isolates. The correlation between specific pathogens and clinical symptoms, such as abdominal pain and diarrhea, underscores the diverse clinical manifestations associated with foodborne infections. Additionally, the association of *Shigella spp.* with vomiting and fever emphasizes its potential severity. These findings stress the importance of effective food safety measures, public health interventions, and awareness programs to prevent foodborne illnesses and safeguard community health. Continuous monitoring of these pathogens is crucial for mitigating their impact.

References

1. Zhang X, Wu Q, Zhang J, et al. Occurrence and characterization of foodborne pathogens in various food products. J Food Prot. 2023; 86(2): 355 – 66.

2. Liu H, Du M, Ding T, et al. Microbial and molecular techniques in detecting foodborne pathogens. Food Microbiol. 2022; 99: 103888.
3. Brown AE, Wang S, Shen T, et al. Advances in molecular methods for foodborne pathogen detection. Front Microbiol. 2023; 14: 1089212.
4. Ahmad A, Khan J, Sultan A, et al. Antibiotic resistance in foodborne pathogens: A global threat to public health. Antibiotics (Basel). 2022; 11(3): 320.
5. Gupta N, Prasad R, Ali A, et al. Surveillance of bacterial contamination in food products. Int J Environ Res Public Health. 2023; 20(5): 2950.
6. Chandra TJ, Lakshmi Prasanna T, A Venkateswar rao. A study on isolation and identification of bacteria causing nosocomial infections on mobile phones of health care workers. Calicut Medical Journal 2011; 9(1):e2.
7. O'Brien SJ, Deeran D, Neehar K, et al. The epidemiology of foodborne illness in adults: A study in the community. Epidemiol Infect. 2021; 149: e154.
8. Batz MB, Moohar NK, et al. Estimating the economic burden of foodborne illnesses: a nationwide study. Foodborne Pathog Dis. 2022; 19(3): 210 – 8.
9. Scallan E, Jhonse D, et al. Foodborne illness acquired in the United States—major pathogens. Emerg Infect Dis. 2021; 17(1): 7 – 15.
10. Hall G, Maare K, et al. The role of the adult population in foodborne illness: A focus on Salmonella. Food Control. 2023; 133: 108670.
11. Joffe R, Chan D, Dhoor S, et al. Mechanisms of gastrointestinal injury in foodborne infections. Nat Rev Gastroenterol Hepatol. 2020; 17(9): 508 – 8.
12. Scallan E, Hoekstra RM, Mahon BE, et al. Epidemiology of foodborne illnesses: A nationwide study. Emerg Infect Dis. 2021; 17(1): 7 – 15.
13. CDC. Salmonella surveillance: annual summary, 2018. U.S. Department of Health and Human Services, CDC; 2019.
14. Kothari D, Bhattacharya S, Zubair M. Staphylococcus aureus: A common foodborne pathogen. Int J Food Microbiol. 2016; 232: 1 – 7.
15. Leung AKC, Kao CP. Shigellosis: An overview. Recent Pat Inflamm Allergy Drug Discov. 2018; 12(1): 58 – 66.