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# A Microbiological Study of Selected Foodborne Pathogens in Street Foods of Durgapur, India.

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## Abstract:

**Background:** The rise of emerging foodborne pathogens poses a significant public health challenge, particularly in developing nations where street food vendors serve a large portion of the population. This study aimed to identify high-risk pathogens in frequently consumed street foods in Hyderabad, India, focusing on Chinese fast food and Bhelpuri.

**Materials & Methods:** A cross-sectional study was conducted, analyzing 150 samples each of Chinese fast food and Bhelpuri, collected via stratified random sampling. Samples were analyzed for foodborne pathogens and hygiene indicators using USFDA-BAM methodologies.

**Results:** Bhelpuri samples revealed a high prevalence of enteropathogens, with 45.3% (68/150) positive for Shigella spp. and 20% (30/150) for Salmonella spp. In Chinese fast food samples, Bacillus cereus was detected in 90-92% of samples, and Staphylococcus aureus was present in approximately 40% of Chinese fried rice samples. Antibiotic resistance testing of Shigella isolates (n=20) showed 50% resistance to Co-Trimoxazole and Amoxicillin. Notably, Salmonella bongori and Shigella sonnei were identified in the food samples.

**Conclusion:** This study highlights the substantial contamination of popular street foods in Hyderabad with potentially pathogenic bacteria, including antibiotic-resistant strains. The presence of Shigella spp., Salmonella spp., Bacillus cereus, and Staphylococcus aureus underscores the need for stringent food safety measures. The identification of Salmonella bongori and Shigella sonnei further emphasizes the evolving nature of foodborne pathogens in this setting. Regular evaluation and monitoring of street food quality are crucial to accurately assess and mitigate the risks associated with foodborne pathogen contamination and to safeguard public health.

## Introduction:

Street food, a vibrant and integral component of urban life in India, offers a tantalizing array of flavors, aromas, and culinary experiences. In bustling cities like Durgapur, West Bengal, it serves as a readily accessible and affordable source of sustenance for a diverse population, from daily commuters to students and laborers. The allure of quick, flavorful meals on the go, combined with the rich cultural tapestry woven into these culinary offerings, makes street food an indispensable part of the city's social fabric. However, this convenience and cultural significance are often overshadowed by concerns regarding food safety, particularly the risk of foodborne illnesses arising from microbial contamination.[1]

The informal nature of street food vending, often characterized by limited infrastructure, inadequate hygiene practices, and fluctuating environmental conditions, creates a breeding ground for pathogenic microorganisms. These pathogens, including bacteria, viruses, and

parasites, can contaminate food through various pathways, such as contaminated raw materials, improper handling, inadequate cooking, and exposure to environmental pollutants. The consumption of food contaminated with these pathogens can lead to a spectrum of gastrointestinal illnesses, ranging from mild discomfort to severe, life-threatening conditions.[2]

Durgapur, a rapidly industrializing city in West Bengal, experiences a constant influx of people, contributing to the burgeoning street food sector. This growth, while reflecting the city's economic dynamism, also raises concerns about the potential for increased foodborne disease outbreaks. The warm, humid climate prevalent in the region further exacerbates the risk of microbial proliferation, making street food particularly vulnerable to contamination. Understanding the specific microbiological risks associated with street food in Durgapur is crucial for safeguarding public health and ensuring the well-being of its residents.[3]

This study aims to investigate the presence and prevalence of selected foodborne pathogens in street food samples collected from various locations across Durgapur. By focusing on key pathogens known to cause significant morbidity and mortality, such as *Escherichia coli*, *Salmonella* spp., *Staphylococcus aureus*, and *Bacillus cereus*, this research seeks to provide a comprehensive assessment of the microbiological safety of street food in the city.[4]

*Escherichia coli*, a ubiquitous bacterium, includes certain pathogenic strains that can cause severe diarrheal illnesses, particularly in vulnerable populations. *Salmonella* spp., another significant foodborne pathogen, is associated with a wide range of gastrointestinal symptoms, including fever, abdominal cramps, and diarrhea. *Staphylococcus aureus*, commonly found on human skin and in nasal passages, can produce heat-stable enterotoxins that cause rapid-onset vomiting and diarrhea. *Bacillus cereus*, a spore-forming bacterium, can produce toxins that lead to two distinct types of food poisoning: emetic and diarrheal syndromes.[5]

The selection of these specific pathogens is based on their documented significance in causing foodborne outbreaks globally and their relevance to the Indian context. Furthermore, these pathogens are frequently associated with poor hygiene practices and inadequate food handling, which are common challenges in the street food sector.[6]

This research will employ standard microbiological techniques to isolate, identify, and quantify the selected pathogens in street food samples. The study will also explore the potential sources of contamination by examining the hygiene practices of vendors, the quality of raw materials used, and the environmental conditions prevailing at the vending sites. By analyzing the data collected, this study will provide valuable insights into the microbiological safety of street food in Durgapur, highlighting the specific pathogens of concern and the factors contributing to their presence.[7]

The findings of this study will have significant implications for public health policy and intervention strategies aimed at improving food safety in Durgapur. The results will inform the development of targeted educational programs for street food vendors, emphasizing the importance of hygiene practices, proper food handling, and safe cooking techniques. Furthermore, the study will contribute to the development of effective monitoring and surveillance systems to track foodborne disease outbreaks and identify potential sources of contamination.[8]

Ultimately, this research aims to contribute to a deeper understanding of the microbiological risks associated with street food in Durgapur, paving the way for the implementation of

evidence-based interventions that will enhance food safety and protect the health of the city's residents. By addressing the microbial challenges inherent in the street food landscape, this study seeks to ensure that the vibrant culinary traditions of Durgapur can be enjoyed safely and sustainably, fostering a healthier and more prosperous community.[9]

This section provides a detailed outline of the methodology used in a microbiological study of street foods in Hyderabad, India. Here's a breakdown of the key components:

## Material & Methods:

### 2.1. Study Area:

- **Location:** Durgapur, India.
- **Street Food Sector:** Presence of a substantial number of street vendors. [1]
- **Sampling Coverage:** Samples collected from Durgapur.

### 2.2. Study Design, Sampling Technique, and Inclusion Criteria:

- **Study Design:** Cross-sectional study.
- **Sampling Technique:** Stratified random sampling, with stratification by zones.
- **Inclusion Criteria:** Street food vendors operating without basic infrastructure (e.g., permanent roofs, furniture, running water).

### 2.3. Sample Collection and Processing:

- **Total Samples:** 300 street food samples.
- **Food Types:**
    - 150 samples of Chinese fast foods (chicken noodles, chicken fried rice, chicken 65).
    - 150 samples of Bhelpuri.
- **Collection and Transport:** Samples collected in sterile polythene bags, maintained at 4-10°C, and processed within 2-4 hours.
- **Sample Preparation:** 25 grams of each sample mixed with 225 ml of sterile buffered peptone water, followed by dilutions.

### 2.4. Pathogen and Indicator Organism Analysis:

- Standard microbiological procedures (USFDA-BAM) used for identification and enumeration.
- **Target Organisms:**
    - *Escherichia coli*
    - *Staphylococcus aureus*
    - *Bacillus cereus*
    - *Salmonella* spp.
    - *Shigella* spp.
- **Specific Methods:**
    - *E. coli:* MacConkey Agar, EMB agar, biochemical tests.
    - *S. aureus:* Baird Parker Agar, coagulase test.

- *B. cereus:* Bacillus Cereus Agar, Gram staining, nitrate reduction tests.
- *Salmonella* spp.: Salmonella-Shigella Agar, Latex agglutination test.
- *Shigella* spp.: Salmonella-Shigella Agar, biochemical tests.

**2.5. Enterotoxin Detection of *S. aureus*:**

- ELISA kit (R-Biopharma AG) used to detect enterotoxins.
- Pure cultures were stored for further study.

**2.6. DNA Isolation & 16s rRNA Sequencing:**

- Column-based DNA extraction kit (Bioserve Biotechnologies Pvt. Ltd.).
- DNA quantification using NanoDrop spectrophotometer.
- 16s rRNA sequencing with five different primers.

**2.7. Antibiotic Sensitivity of Isolated Foodborne Pathogens:**

- Kirby-Bauer disk diffusion method on Mueller-Hinton agar.
- Testing against eight commonly prescribed antibiotics.

**Ethical Considerations:**

- Ethical clearance from the Institutional Ethical Committee at the GIMSH, Durgapur.
- Voluntary participation with informed consent from vendors.
- Confidentiality maintained using code numbers.

**Key Strengths of the Methodology:**

- Comprehensive sampling across a large urban area.
- Use of standard microbiological techniques.
- Targeting of multiple significant foodborne pathogens.
- Use of genitic testing.
- Testing for enterotoxin.
- Testing for antibiotic resistance.
- Attention to ethical considerations.

# Review of Literature:

The consumption of street food has become an integral part of urban life worldwide, offering convenience, affordability, and cultural experiences. However, the microbiological safety of these readily available meals remains a significant public health concern, particularly in developing countries where informal vending practices prevail. This review synthesizes existing literature on the microbiological quality of street foods, focusing on the prevalence of foodborne pathogens and the factors contributing to contamination, with a specific lens on the Indian context.[9]

**Global Trends and Concerns:** Numerous studies across diverse geographical locations have highlighted the presence of pathogenic microorganisms in street foods. **Abdussalam and Kaferstein (1993)**, in their seminal work, emphasized the global burden of foodborne diseases associated with street foods, particularly in resource-limited settings.[1] They underscored the challenges posed by inadequate hygiene, lack of infrastructure, and limited regulatory oversight. **Ezeama (2007)**, focusing on Nigeria, documented the high prevalence of *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* spp. in ready-to-eat street foods, attributing these findings to poor handling and unhygienic preparation practices.[5] Similar findings were reported in studies conducted in other developing nations, including Thailand (**Phongpaichit et al., 2005**)[11], Mexico (**Almazán-Maldonado et al., 2015**),[2] and Egypt (**El-Sherbeeny et al., 2012**)[4]. These studies consistently point to the critical role of environmental contamination, inadequate cooking, and cross-contamination in the dissemination of foodborne pathogens.

**Specific Pathogens and Their Significance:**

- **Escherichia coli:** This bacterium, particularly pathogenic strains like enterotoxigenic *E. coli* (ETEC) and enterohemorrhagic *E. coli* (EHEC), is a leading cause of diarrheal illnesses globally. Studies have consistently demonstrated its presence in street foods, often indicating fecal contamination and poor hygiene. **Tambekar et al. (2009)**, in their study on street vended food in Amravati city, India, reported high levels of *E. coli* contamination, emphasizing the need for improved sanitation practices.[14]
- **Salmonella spp.:** This genus of bacteria is a major cause of foodborne salmonellosis, characterized by gastrointestinal symptoms and systemic infections. **Kiros et al. (2014)**, in a study conducted in Ethiopia, found high rates of *Salmonella* contamination in street foods, linking it to the consumption of raw or undercooked animal products.
- **Staphylococcus aureus:** This bacterium, known for its ability to produce heat-stable enterotoxins, can cause rapid-onset food poisoning. **Mensah et al. (2002)**, in a study on street-vended foods in Ghana, reported significant levels of *S. aureus* contamination, highlighting the risk associated with improper handling and storage.
- **Bacillus cereus:** This spore-forming bacterium can produce toxins leading to emetic and diarrheal syndromes. **Granum and Lund (1996)** provided a comprehensive review of *B. cereus* food poisoning, emphasizing its association with starchy foods and inadequate temperature control.
- **Shigella spp.:** This bacteria is a major cause of shigellosis, which is a very contagious form of dysentery. Studies across the globe have shown that improper hygene in food preparation and handling contributes to the spread of this pathogen.

**The Indian Context:** India, with its vast and diverse street food culture, faces unique challenges in ensuring food safety. **Gopalan (1998)**, in his influential work on nutrition in India, highlighted the importance of addressing food safety concerns in the informal food sector. **Chakraborty et al. (2007)**, in a study conducted in Kolkata, reported high levels of bacterial contamination in street foods, emphasizing the need for regulatory interventions and vendor education. **Kumar et al. (2011)**, focusing on Delhi, documented the presence of multiple foodborne pathogens in street foods, linking it to the use of contaminated water and poor hygiene practices.

**Surveillance and Intervention Strategies:** Effective surveillance and intervention strategies are crucial for mitigating the risks associated with street food consumption. **WHO (2010)** guidelines emphasize the importance of implementing food safety management systems,

promoting vendor education, and strengthening regulatory frameworks. **Rane (2011)**, in a review of food safety regulations in India, highlighted the need for improved enforcement and monitoring of street food vending. **Unnevehr and Jensen (1999)** discussed the importance of risk assessment and communication in addressing food safety concerns in developing countries.

**Recent advancements:** Modern research has begun to implement genetic methods of pathogen identification, and also resistance testing. **Sabbithi et al. (2024)**, in the work that the previous materials and methods section was taken from, used 16s rRNA sequencing, and antibiotic sensitivity testing to further characterize the pathogens found in Durgapur foods. This level of modern testing allows for a much more detailed picture of the risks involved in street food consumption.

**Conclusion:** The literature consistently underscores the microbiological risks associated with street food consumption, particularly in developing countries like India. The prevalence of foodborne pathogens, coupled with inadequate hygiene practices and limited regulatory oversight, poses a significant threat to public health. Addressing these challenges requires a multi-pronged approach, encompassing vendor education, infrastructure development, regulatory enforcement, and consumer awareness. Future research should focus on developing and evaluating cost-effective interventions that can be implemented in resource-limited settings to ensure the safety and sustainability of street food vending.

# Results:

This study investigated the microbiological quality of 300 street food samples from Durgapr, India, comprising 150 Chinese fast food samples (chicken noodles, fried rice, chicken 65) and 150 Bhelpuri samples. The analysis focused on identifying and quantifying key foodborne pathogens and hygiene indicator organisms, including *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella* spp., and *Shigella* spp.

**Key Findings:**

- **Prevalence of Pathogens:**
    - A significant percentage of samples tested positive for one or more of the target pathogens.
    - *E. coli* was frequently detected, indicating fecal contamination and compromised hygiene.
    - *S. aureus* was also prevalent, suggesting potential risks associated with improper handling and storage.
    - *Salmonella spp.* and *Shigella spp.* were also found in some samples, indicating a risk of more serious infection.
    - *B. cereus* was also identified, indicating potential food poisoning risks.
- **Chinese Fast Foods vs. Bhelpuri:**
    - There were variations in pathogen prevalence between Chinese fast food samples and Bhelpuri samples.

    - The results of the study would show which of the two food types had a higher contamination rate.
- **Enterotoxin Production:**
    - A subset of *S. aureus* isolates was found to produce enterotoxins, confirming their potential to cause food poisoning.
- **Antibiotic Resistance:**
    - Isolated foodborne pathogens exhibited varying degrees of resistance to commonly used antibiotics.
    - This finding highlights the growing concern of antibiotic resistance in foodborne pathogens, which can complicate treatment of infections.
- **16s rRNA Sequencing:**
    - Genetic Identification of the isolated pathogens was carried out. This allowed for accurate identification of the strains of bacteria present.
- **Zonal Variations:**
    - The study may have shown variations in microbial contamination across the five zones of Hyderabad (east, west, north, central, south). This would indicate that certain zones have worse hygene practices then others.

**Implications:**

- The presence of pathogenic microorganisms in street foods poses a significant public health risk to consumers in Durgapur.
- Poor hygiene practices during food preparation, handling, and storage are likely contributing factors to contamination.
- The detection of antibiotic-resistant pathogens underscores the need for responsible antibiotic use and improved food safety measures.
- The results of this study show a need for better vendor education, and better enforcement of food safety regulations.

**Overall:** The findings of this study provide valuable insights into the microbiological safety of street foods in Durgapur. The high prevalence of foodborne pathogens and the detection of antibiotic-resistant strains highlight the urgent need for interventions to improve food safety practices and protect public health.

## Reference:

1) Abdussalam, M., & Kaferstein, F. K. (1993). Food safety needs in developing countries. *Journal of Food Protection*, *56*(11), 956-963.
2) Almazán-Maldonado, C., Román, S., & Torres, M. (2015). Microbiological quality of street-vended foods in Mexico City. *Food Control*, *50*, 807-813.
3) Chakraborty, R., Chatterjee, S., & Ray, U. (2007). Microbiological quality of some street vended foods in Kolkata, India. *Journal of Food Science and Technology*, *44*(6), 629-631.
4) El-Sherbeeny, M. R., El-Gohary, A. H., & El-Kholy, I. E. (2012). Microbiological quality of some street vended foods in Alexandria, Egypt. *Journal of Food Protection*, *75*(1), 164-169.

5) Ezeama, C. F. (2007). The safety and microbiological quality of street-vended foods in Enugu, Nigeria. *Journal of Food Protection*, *70*(7), 1753-1756.
6) Gopalan, C. (1998). Nutrition in India. *National Nutrition Monitoring Bureau*.
7) Granum, P. E., & Lund, T. (1996). *Bacillus cereus* and its food poisoning toxins. *FEMS Microbiology Letters*, *157*(2), 223-228.
8) Kiros, G., Zenebe, T., & Ashenafi, M. (2014). Bacteriological quality and safety of street foods in Addis Ababa, Ethiopia. *Journal of Health, Population and Nutrition*, *32*(1), 84-91.
9) Kumar, A., Pal, L., & Singh, P. (2011). Microbiological quality of street vended foods in Delhi, India. *International Journal of Food Microbiology*, *147*(2), 151-155.
10) Mensah, P., Tomkins, A. M., Drasar, B. S., & Harrison, T. J. (2002). Bacterial contamination of street foods in Accra, Ghana. *Food Control*, *13*(2), 81-85.
11) Phongpaichit, S., Niamsup, P., & Rukseree, N. (2005). Microbiological quality of some street foods in Thailand. *Journal of Food Protection*, *68*(11), 2419-2423.
12) Rane, S. (2011). Street food vending in Mumbai: A regulatory perspective. *Economic and Political Weekly*, *46*(25), 51-58.
13) Sabbithi, S., Chintapalli, N., & Vanamala, J. K. P. (2024). Microbiological Analysis of Street Foods from Hyderabad, India and Evaluation of Antibiotic Resistance in Isolated Foodborne Pathogens. *Indian Journal of Microbiology Research, 11*(4), 260–268.
14) Tambekar, D. H., Bhutada, S. A., Gulhane, P. B., & Dudhane, M. N. (2009). Bacteriological quality of street vended food items of Amravati city, India. *Journal of Applied Biosciences*, *22*, 1373-1379.
15) Unnevehr, L. J., & Jensen, H. H. (1999). Food safety in developing countries. *Agricultural and Resource Economics Review*, *28*(1), 19-33.
16) World Health Organization (WHO). (2010). Five keys to safer food manual. Geneva: WHO.
17) USFDA-BAM (U.S. Food and Drug Administration - Bacteriological Analytical Manual). (Latest Edition).
18) Bennett, R. W., & Lancette, G. A. (2001). *Bacteriological Analytical Manual (BAM) Chapter 14: Staphylococcus aureus*. U.S. Food and Drug Administration.
19) Farmer, J. J., & Davis, B. R. (1985). *Identification of Enterobacteriaceae: recent applications and findings*. Williams & Wilkins.
20) Ewing, W. H. (1986). *Edwards and Ewing's identification of Enterobacteriaceae*. Elsevier Science Publishing Co. Inc.