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RESEARCH ARTICLE OPEN ACCESS

Isolation and Identification of *E. coli* from Street Foods, Coimbatore

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Abstract

This study explores the occurrence of *Escherichia coli* (*E. coli*) in street food samples collected from street food outlets in Coimbatore, Tamil Nadu, India. *E. coli*, a versatile bacterium and common intestinal microflora component, is frequently implicated in foodborne illnesses linked to contaminated food and water. This research aimed to evaluate the hygienic conditions of street foods in Coimbatore to establish a baseline for preventive measures and raise awareness. A total of 15 food samples, including both vegetable-based and meat-based items, were analysed for *E. coli* contamination. The samples were processed and tested following standard bacteriological methods. The findings indicate that 73.3% of the samples tested positive for *E. coli*, highlighting significant contamination concerns. The study highlights the influence of inappropriate food hygiene and cooking on *E. coli* prevalence. This emphasizes the urgent necessity for enhanced food safety practices, improved hygiene training for vendors, and stricter enforcement of food safety regulations to reduce contamination risks and safeguard public health.

Keywords: *Escherichia coli,* Food Safety, Street Food, Contamination, Hygiene Practices, Coimbatore, India

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INTRODUCTION

Escherichia coli (*E. coli*) is a highly adaptable bacterium capable of thriving in diverse and stressful biotic and abiotic environments. This microorganism, which establishes itself as a major component of the intestinal microflora, colonizes the neonatal gut shortly after birth.[1] The success of *E. coli* colonization is attributed to its metabolic versatility and competitive abilities. The organism's abundance in the gut is influenced by dietary habits and hygiene practices more than ecological conditions, as the strain competes for nutrients in various ways: directly utilizing available nutrients, outgrowing other strains, or engaging in symbiotic associations with anaerobes.[2]

Foodborne infections globally are often linked to the contamination of food and water with *E. coli*.[3] *E. coli* has been linked to various food products, including both meat and fresh produce. Poultry and meat provide high-quality protein but are prone to contamination, while fresh produce, although generally considered healthy,[4] can harbour significant bacterial populations. Street foods, valued for their distinct flavours and accessibility, are particularly susceptible to contamination.[5]

E. coli, recognized for its sensitivity to heat, has been identified as a contaminant in multiple studies conducted in different regions of India.[6] However, there is limited research on street food's microbial quality and hygiene in Tamil Nadu. This study aims to assess the hygienic conditions of ready-to-eat foods available in Coimbatore, Tamil Nadu, intending to create a baseline database for preventive measures and raise awareness.

MATERIALS AND METHODS

Collection of street food samples

A diverse selection of street food samples was gathered from street outlets in Coimbatore, Tamil Nadu. Food items included steamed corn, sandwiches, mixed vegetable salad, cutlets, pani puri, bhel puri, mushroom masala, jigardhanda, chicken tandoori, fish fingers, prawn gravy, boti masala, brain masala, liver fry, and tuna subway (Table 1). Samples were collected in sterile polythene bags, transported in an ice chest, and stored at 3 °C until processing. Bacteriological analyses were performed within 12 hours of sample collection.

With some modifications, the study of *E. coli* was conducted following the United States Food and Drug Administration, Bacteriological Analytical Manual, Chapter 4A. Each sample was diluted at a ratio of 1:10. A 10 g portion of each sample was finely chopped and homogenized in ninety ml of BPB (Himedia, Mumbai) and then incubated at 36 °C for 18 hours for pre-enrichment. After pre-enrichment, 1 ml of the mixture was transferred to 9 ml of Lactose Broth (LB) (Himedia, Mumbai) and incubated at 36 °C for 18 hours.

Isolation

A loopful of the enriched culture turned into streaked onto Eosin Methylene Blue agar plates and incubated at 36 °C for 18 ± 2 hours. Colonies displaying a steel green sheen with darkish-focused purple were selected.

Biochemical Characterization of *E. coli*

Biochemical exams for identification of *E. coli* covered IMViC exams: Indole, Methyl purple, Voges-Proskauer, and Citrate usage. Positive isolates were preserved in Nutrient Agar (NA) by stabbing in soft agar medium and stored at room temperature.

Indole test

Utilized SIM agar containing tryptophan to detect the degradation of tryptophan into indole. The presence of indole is shown through the addition of Kovac's reagent, resulting in a cherry purple coloration.

Methyl red test

Conducted using MR-VP media to determine glucose oxidation and acid production. MR indicator turns red at pH 4, indicates a positive result.

Voges-Proskauer

Assessed the acetylmethylcarbinol production from glucose metabolism using MR-VP media. The presence of a pink complex after adding Barritt's reagent A & B indicates a positive result.

Citrate utilization test

Used Simmon citrate agar to discover their ability to use citrate as a carbon source. A blue coloration indicated a positive result.

RESULTS

Screening

A total of 15 prepared-to-consume meal samples, comprising 8 vegetable-based and 7 meat-primarily based items, had been analysed. Out of these, 11 samples (73.3%) tested positive for *E. coli*, while 4 samples were negative. *E. coli* identified on the distinctive color on Eosin Methylene Blue agar (Table 2).

Table 1. List of Coimbatore Street food samples

Street plant food samples (N = 8)	Street meat-based food samples (N = 7)
Steamed corn	Chicken tandoori
Sandwich	Fish finger
Mixed veg salad	Prawn gravy
Cutlet	Boti masala
Pani puri	Brain masala
Bhel puri	Liver fry
Mushroom masala	Tuna Subway
Jigardhanda	

Table 2. Identification of *E. coli* from street food samples

Street food samples	I	MR	VP	C	Presence of *E. coli*
Steamed corn	+	+	-	+	Negative
Sandwich	-	+	+	+	Negative
Mixed veg salad	+	+	-	+	Negative
Cutlet	+	-	-	+	Negative
Pani puri	+	+	-	-	Positive
Bhel puri	+	+	-	-	Positive
Mushroom masala	+	+	-	-	Positive
Jigardhanda	+	+	-	-	Positive
Chicken tandoori	+	+	-	-	Positive
Fish finger	+	+	-	-	Positive
Prawn gravy	+	+	-	-	Positive
Boti masala	+	+	-	-	Positive
Brain masala	+	+	-	-	Positive
Liver fry	+	+	-	-	Positive
Tuna subway	+	+	-	-	Positive

DISCUSSION

The superiority of *E. coli* in 73.3 % of the tested prepared-to-devour food samples from Coimbatore display enormous contamination issues. This high contamination rate can be attributed to cross-contamination from animal sources, inadequate hygiene practices, and improper food handling and storage. These findings are consistent with previous research indicating that poor hygiene and inadequate cooking conditions contribute to *E. coli* infection.[7,8]

Street food vendors in Coimbatore often lack basic hygiene awareness and practices, such as proper hand washing and utensil cleaning. Many vendors prepare food in open environments exposed to potential contaminants from surrounding traffic and environmental factors. Furthermore, food handling practices, such as using unwashed hands and improper storage, exacerbate contamination risks.

Vegetable salads and pre-prepared foods, like those sold as jigardhanda, also showed high *E. coli* contamination, suggesting inadequate washing and preparation methods. They have a look at highlights of the need for processed food protection practices, such as better hygiene education for vendors and stricter enforcement of meal protection rules.

This has a look at underscores the crucial need for superior meal safety measures and consumer consciousness to mitigate the dangers associated with *E. coli* infection in avenue foods. Implementing proper hygiene practices and ensuring thorough cooking and storage conditions are essential to reducing the prevalence of foodborne pathogens.

Measures to prevent contamination

Food safety

Food safety is a pressing global issue influenced by the rapid evolution of dietary habits. Street-vended foods, which encompass both ready-to-eat items and those prepared on-site, form a significant part of urban food supplies and contribute substantially to the national economy. In Coimbatore, the variety of vending setups ranges from mobile carts to fixed stalls and restaurants. However, these facilities often lack essential infrastructure such as potable water, sanitation,

refrigeration, and waste disposal systems. Many food vendors operate from unhygienic roadside locations with inadequate sanitation and safety standards. This situation compromises food safety due to challenges in managing large crowds, limited knowledge about microbial contamination, insufficient public awareness of foodborne illnesses, and inadequate food inspection and periodic laboratory analysis.

To mitigate contamination risks, it is crucial to adhere to safe food handling practices throughout all stages of food preparation. Vendors must ensure high standards of food hygiene and handlers should maintain personal cleanliness and safe food practices.

Several experimental methods have been investigated to reduce microbial contamination in food production. Numerous experimental techniques were investigated to lessen microbial contamination in food production. strategies together with ultrasound, high pressure, high-depth electric subject pulses, ultraviolet radiation, radio frequency, ionizing radiation, high-strain remedy, pulsed electric fields, X-ray irradiation, microwave remedy, cold plasma, excessive-intensity pulsed light, and thermal destruction the use of condensing steam have been proven to significantly reduce microbiological loads in clean produce and increase shelf lifestyles.[9]

The food generation department at Bhabha Atomic Research Centre (BARC) in Mumbai has indicated that irradiation is a surprisingly powerful technique for putting off foodborne pathogens compared to warmth and chemical remedies. Radiation applications are classified into low (0.03-1 kGy), medium (1.5-10 kGy), and heavy (25-70 kGy) doses for various food products. Over 30 countries, including India, have endorsed radiation processing, though its commercial use remains limited. The Joint Expert Committee of FAO, WHO, and IAEA concluded in 1980 that radiation doses up to 10 kGy are safe for human consumption and do not present significant nutritional, microbiological, or toxicological concerns. Despite its effectiveness, irradiation can be cost-prohibitive.

In 2012, the Bureau of Indian Standards (BIS) established guidelines for street food vendors to ensure food safety. These standards cover both mobile and fixed food vending operations serving both raw and cooked foods. Food Safety and Standards Authority of India (FSSAI) has also initiated the "Easy Street Meals" undertaking to improve seller hygiene practices. However, the implementation of such policies in Tamil Nadu has faced challenges due to insufficient support from municipal authorities.[10]

This study highlights the unsanitary conditions prevalent among street food vendors, underscoring the need for enhanced hygiene awareness and infection control measures to combat *E. coli* contamination.

Similar concerns were echoed in European reports documenting antimicrobial resistance trends in zoonotic and foodborne bacteria.[11]

CONCLUSION

This research focused on detecting *E. coli* infection in geared up-to-eat food samples from Coimbatore, Tamil Nadu, India. The observation encompassed the detection of *E. coli* in street food samples from various merchandising locations. Fifteen food samples, including eight vegetable-based and seven meat-based items, were collected from diverse sources such as roadside shops, restaurants, and fast-food stalls. Out of these, eleven samples tested positive for *E. coli*, while four did not. The positive isolates were confirmed through biochemical testing. The elevated rate of infection credited through inadequate hygiene practices, improper storage conditions, and insufficient cooking temperatures.

The verdicts accentuate the life-threatening reputation of maintaining food hygiene, proper handling practices, and thorough cooking. *E. coli* contamination in prepared-to-consume ingredients is probably exacerbated by the improper disposal of human waste, open dumping of solid waste, and infection of water sources. Additionally, self-medication and misuse of antibiotics can lead to the adaptation of *E. coli*, increasing its prevalence in sewage and potentially contaminating food supplies.

To prevent *E. coli* transmission, it is recommended to implement basic hygiene practices, such as proper handwashing, and to educate food handlers on safe food preparation techniques. Raising public awareness about these issues is essential to prevent further adaptation of

E. coli to antibiotics and to improve overall food safety.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

AJ designed the work. JFCR performed the experiments, generated data and wrote the manuscript. AJ reviewed, edited and approved the final manuscript for publication.

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DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

ETHICS STATEMENT

Not applicable.

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