



International Journal of Agriculture and Nutrition

ISSN Print: 2664-6064

ISSN Online: 2664-6072

NAAS Rating (2026): 4.69

IJAN 2026; 8(9): 120-123

www.agriculturejournal.net

Received: 22-06-2026

Accepted: 08-08-2026

Published: 25-09-2026

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A review on food safety, good hygiene practices, and sanitation of non-vegetarian street food vendors

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DOI: <https://www.doi.org/10.33545/26646064.2026.v8.i9b.753>

ABSTRACT

Street-vended food represents an important component of the urban food system, providing affordable, convenient and readily accessible food to large sections of the population. Non-vegetarian street foods, however, require particular attention because meat, poultry, fish and other animal-derived foods are highly perishable and can support the multiplication of pathogenic microorganisms. The food safety risks associated with non-vegetarian street vending may occur at several stages, beginning with procurement and transportation of raw materials and continuing through preparation, cooking, holding, serving and disposal of waste. The present review emphasis on microbial hazards, personal hygiene, handwashing, environmental sanitation, water availability, waste management, temperature control, socio-economic constraints and regulatory interventions. In regards to the street food nowadays, frequent occurrence of significant food borne pathogens, including *Salmonella*, *Escherichia coli* and *Staphylococcus aureus* are found. Poor hygiene, simultaneous handling of money and food, inadequate separation of raw and cooked products, absence of potable running water, improper waste disposal and prolonged holding of cooked foods under unsuitable temperatures contribute substantially to the risk of contamination. Sustainable improvement therefore requires an integrated approach involving vendor education, accessible water and sanitation facilities, appropriate food-storage infrastructure, regular risk-based inspection and supportive municipal interventions.

Keywords: Street food, Food safety, Good Hygiene Practices, Sanitation, Food borne pathogens, Public health

1. Introduction

Street food vending is an important component of the food economy in many developing countries like India. It provides affordable and convenient meals to urban populations and represents an important source of income for individuals and families involved in small scale food business. Although street food contributes substantially to food accessibility and urban livelihoods, consumers also consider cleanliness, hygiene and the general appearance of food vendors when selecting street-foods. Unlike many dry or minimally processed foods, animal products require careful control throughout procurement, transportation, storage, preparation and cooking. The food safety problem does not arise from a single factor. Rather, it represents the interaction of biological hazards, environmental contamination, inadequate infrastructure, poor personal hygiene, inappropriate temperature control, unsafe water, inadequate waste disposal and economic constraints. The World Health Organization (WHO) similarly emphasizes five fundamental principles for safer food handling: keeping clean, separating raw and cooked food, cooking food thoroughly, maintaining food at safe temperatures, and using safe water and raw materials. These principles are particularly relevant to non-vegetarian street vending, where raw animal products and ready-to-eat foods may be handled within a limited working area.

In India, street food vendors fall within the food safety and hygiene framework of the Food Safety and Standards Authority of India (FSSAI). FSSAI identifies specific hygienic and sanitary requirements for petty food operators and street food vendors under Schedule 4 of the Food Safety and Standards regulations. However, the implementation of food safety measures at the street-vending level remains challenging. Therefore, the objective of this review is to examine the major food safety hazards associated with non-vegetarian street foods and critically discuss the role of personal hygiene, GHP, sanitation, infrastructure, socioeconomic conditions and regulatory interventions in reducing food safety risks.

2. Food safety vulnerability of non-vegetarian street foods

2.1 Biological hazards associated with animal-derived foods

Non-vegetarian street foods are particularly vulnerable to microbiological contamination because raw animal products may carry microorganisms before they reach the vending site. The reviewed literature identifies *Salmonella enterica*, *Escherichia coli* and *Staphylococcus aureus* among the organisms of concern. The food safety problems may begin at the sourcing stage, particularly when meat is obtained from poorly maintained wet-market environments [Tambekar et al. \(2011\) \[1\]](#). Raw meat transported without adequate temperature control may reach vendors with a considerable microbial load. Consequently, food safety at the vending point is influenced by conditions existing earlier in the food chain.

Most commonly identified pathogens associated with ready-to-eat (RTE) meat products are *Salmonella*, *S. aureus* and *E. coli*. The presence of *S. aureus* is particularly relevant to food handling because humans can serve as an important reservoir, making poor hygiene and direct handling of cooked food potential routes of contamination.

2.2 Raw material procurement and the cold chain

Food safety begins before food reaches the vending stall. The absence of a reliable cold chain is a recurrent problem. Street vendors frequently purchase meat from local markets and transport it under ambient conditions. In warm climates, prolonged exposure to temperatures favourable for microbial multiplication may accelerate deterioration. This is important because cooking should not be regarded as a complete solution to all previous food safety failures. Although, adequate cooking can destroy many vegetative bacterial cells, subsequent handling, storage and serving can result in recontamination. Therefore, food safety requires control throughout the food chain rather than dependence on the final cooking step alone.

3. Temperature control and microbial growth

Temperature control is one of the key components of food safety for non-vegetarian foods. Temperature abuse has two major implications. First, microorganisms already present in food may multiply during prolonged holding. Second, foods that have been adequately cooked may become unsafe after post-cooking contamination followed by prolonged storage under favourable growth conditions. WHO food safety guidance emphasizes the importance of maintaining food at safe temperatures and recommends prompt refrigeration of perishable cooked foods. For street vendors, however, implementation can be difficult because refrigeration requires electricity, equipment, space and financial investment. Thus, temperature control should be considered both a technical and socio-economic issue.

4. Handling of money and food: a critical cross-contamination route

One of the distinctive characteristics of street food vending is that the same person may perform several tasks simultaneously. A vendor may purchase or handle raw meat, prepare food, receive currency, serve customers and clean utensils without assistance. The problem becomes particularly serious when ready-to-eat foods are handled directly by hand. If a vendor touches contaminated currency and subsequently touches cooked meat, bacterial transfer may occur without any visible indication of contamination. Separation of food-handling and cash-handling responsibilities would reduce this risk. In single-vendor operations, however, practical alternatives include frequent handwashing, use of suitable utensils or serving implements, and minimizing direct contact between hands and ready-to-eat foods.

5. Good hygiene practices (GHP) in non-vegetarian

street food vending

GHP constitute the practical foundation of food safety at the point of sale. For non-vegetarian street food vendors, GHP should encompass personal hygiene, safe sourcing, appropriate food storage, separation of raw and cooked products, cleaning and sanitation, pest control, waste management and protection of food from environmental contamination.

- a. Cleaning and sanitation of utensils

6. Environmental sanitation and infrastructure

6.1 Water availability

Access to potable water is one of the most important infrastructural requirements for safe street food preparation. Water is required for handwashing, utensil cleaning, surface sanitation and, in some cases, food preparation.

6.2 Waste management

Improper waste management creates an environment favourable for insects, rodents and other vector borne diseases and may increase the likelihood of contamination of food-contact surfaces. The proximity of food preparation areas to accumulated waste is especially problematic for non-vegetarian vendors because animal tissues, bones and food residues can attract pests. Effective waste management should therefore include covered containers, frequent removal of waste and adequate separation between waste-storage areas and food preparation.

6.3 Drainage and surrounding environment

The physical location of a street food stall can also affect food safety. Open-air vending cannot eliminate exposure to dust, insects, traffic-related pollutants and other environmental contaminants. However, the risk can be reduced by using covered food containers, raised preparation surfaces, protective displays and appropriate waste and drainage systems.

7. Chemical hazards and environmental contamination

Food safety should not be limited to microbial hazards. Chemical contamination may also occur in open street-vending environments. Identification of heavy metals including lead, cadmium and copper in street foods exposed to roadside environments is necessary. Such contamination differs from bacterial food poisoning because the effects may be chronic rather than immediately apparent. This emphasizes the importance of the vending environment itself. Location selection, traffic exposure, dust, contaminated surfaces and the quality of water used during food preparation may influence overall food safety. Consequently, sanitation assessment should incorporate both microbiological and chemical hazards rather than focusing exclusively on visible cleanliness.

8. Socio-economic determinants of food safety

Street vending is frequently characterized by small profit margins, informal employment and limited capital. These factors influence the ability of vendors to invest in refrigeration, stainless-steel work surfaces, covered storage, protective clothing, cleaning agents and other food safety equipment. Hygiene is an intangible quality attribute. Consumers cannot always determine whether appropriate hygiene procedures were followed before purchasing a product. Consequently, vendors may have limited immediate economic incentives to invest in invisible food safety measures. Therefore, improving food safety among street vendors should not be based entirely on punitive approaches. Interventions must recognize the economic realities of informal food businesses.

9. Regulatory framework and municipal interventions

India has a formal regulatory framework for food safety. FSSAI's Schedule 4 specifically provides general hygienic and sanitary requirements for petty food operators and street food vendors. It also incorporates GHP and related food safety management principles. Importantly, regulatory interventions are likely to be more effective when they combine inspection with education and infrastructure. The WHO has similarly emphasized practical risk mitigation and community engagement in traditional food markets rather than relying solely on enforcement. Recent WHO experience also demonstrates the potential value of vendor-focused training and practical interventions. In a 2023–2024 traditional-market programme, WHO-supported activities combined training, communication materials and engagement with vendors, with reported improvements in hygiene knowledge and selected sanitation practices.

Regulatory level

Food safety inspection should be risk-based, regular and supportive. Vendors should receive practical feedback following inspection, and compliance should be encouraged through training and accessible infrastructure in addition to legal enforcement.

Consumer level

Consumers can also influence food safety by selecting vendors who demonstrate visible hygienic practices, including covered food, clean utensils, appropriate waste disposal and separation of raw and cooked foods.

10. Research gaps and future perspectives

- A. Microbiological surveillance should be linked with observational assessments of actual food-handling practices. A vendor may demonstrate acceptable visible hygiene while food-contact surfaces or products remain microbiologically contaminated.
- B. More research is needed on non-vegetarian street foods specific to different Indian regions, because food types, climate, vending systems, consumer practices and municipal infrastructure vary considerably.
- C. Future studies should consider antimicrobial resistance in food-borne bacteria regarding resistant enterobacterial strains, indicating the need for integrated surveillance involving veterinary, food and public-health sectors.
- D. Intervention studies should evaluate whether low-cost improvements—such as handwashing stations, improved water storage, separate utensils and covered food displays—can produce measurable reductions in microbial contamination.

11. Recommendations

1. Mandatory periodic food-safety training should be provided to non-vegetarian street food vendors.
2. Handwashing facilities with potable water and soap should be made available near designated vending areas.
3. Vendors should be trained to separate raw animal products from cooked and ready-to-eat foods.
4. Separate utensils and cutting surfaces should be encouraged for raw and cooked foods.
5. Vendors should adopt appropriate temperature-control measures for perishable foods.
6. Cooked foods should be protected from prolonged exposure to ambient temperatures.
7. Covered containers and food displays should be promoted to reduce contamination from dust, insects and the surrounding environment.

8. Municipal authorities should provide regular waste collection and adequate drainage near vending sites.
9. Food safety inspection should combine education, monitoring and corrective action rather than relying exclusively on punitive measures.
10. Vendors should be encouraged to obtain appropriate registration and operate in designated hygienic vending zones.
11. Low-cost sanitation infrastructure should be developed specifically for mobile and informal food vendors.
12. Future food safety programmes should integrate public health, veterinary, municipal and food regulatory authorities.
13. Microbiological monitoring of high-risk non-vegetarian street foods should be strengthened.
14. Intervention programmes should be evaluated using measurable outcomes such as microbial counts, compliance scores and observed hygiene behaviour.

15. Conclusion

Non-vegetarian street food plays an important role in urban food systems and provides livelihood opportunities for small scale business vendors. At the same time, the characteristics of non-vegetarian foods make them particularly susceptible to microbial contamination and spoilage when safe handling, temperature control and sanitation are inadequate. Importantly, the evidence indicates that the food safety problem cannot be attributed solely to insufficient knowledge among vendors. Structural limitations—including inadequate water supply, poor sanitation infrastructure, limited capital, lack of cold-chain facilities and inconsistent regulatory supervision—strongly influence the ability of vendors to translate knowledge into safe practices. Consequently, improving the safety of non-vegetarian street foods requires an integrated approach. Vendor education should be combined with accessible infrastructure, practical GHP measures, regular risk-based inspection and supportive municipal policies. The WHO Five Keys to Safer Food provide a useful conceptual foundation, while the Indian regulatory framework provides the basis for implementation at the national level. Ultimately, the objective should not be to eliminate street food vending, but to create conditions in which vendors can operate safely and economically. Strengthening food safety at this level would contribute not only to the prevention of foodborne illness but also to healthier urban food systems and improved public confidence in street-vended non-vegetarian foods.

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How to cite this article: Sindhura A, Deepika B, Kuri P, Deepika J, SV K. A review on food safety, good hygiene practices, and sanitation of non-vegetarian street food vendors. *International Journal of Agriculture and Nutrition*. 2026;8(9):120-123. doi: <https://www.doi.org/10.33545/26646064.2026.v8.i9b.753>