


REVIEW ARTICLE

Food Safety in Cambodia: A Systematic Narrative Review of Farm-to-Fork Risks, Governance Frameworks, and Priority Interventions

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ABSTRACT

Background: Foodborne diseases are an important yet under-measured public health problem in Cambodia, where rapid urbanization, heavy reliance on informal markets, and uneven control capacity create multiple contamination pathways.

Objectives: To synthesize Cambodia-specific evidence on foodborne disease burden and surveillance, characterize hazards and high-risk foods and settings along the farm-to-fork continuum, analyze food safety governance and regulatory frameworks, identify implementation gaps, and propose priority interventions.

Methods: A systematic narrative review was conducted using a farm-to-fork framework. PubMed (searched January 15, 2026, using: (Cambodia[MeSH] OR Cambodia[Title/Abstract]) AND ("food safety"[MeSH] OR "foodborne diseases"[MeSH] OR "food contamination"[MeSH])) and Google Scholar (first 200 results by relevance) were searched from inception to January 2026. Grey literature was identified from WHO, FAO, and Cambodian ministry websites. A total of 847 peer-reviewed records were identified, with 52 meeting inclusion criteria after screening. Grey literature (n=23) and legal/policy documents (n=3) were also included. Data were extracted on hazards, governance, and system gaps.

Results: National sources reported 135 foodborne disease outbreaks during 2014–2019 (5,825 cases; 81 deaths), representing events meeting national notification criteria with approximately 40% laboratory-confirmed. Surveys indicate frequent contamination of common foods with *Salmonella* spp. (n=456 samples, 2019–2021; chicken 45.6%, pork 32.1%; Chea et al., 2021) and *Staphylococcus aureus* (chicken 67.2%, pork 51.8%; Chea et al., 2021), with emerging antimicrobial resistance.

Conclusion: Converting legislative advances into health gains requires coordinated, One Health-oriented investments in surveillance, laboratories, inspection, infrastructure, training, and risk communication, supported by targeted research.

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1. INTRODUCTION

Foodborne diseases are a major but often underestimated contributor to global morbidity, mortality, and economic loss. The World Health Organization estimates that unsafe food causes 600 million illnesses and 420,000 deaths annually, with disproportionate impacts in low- and middle-income countries (World Health Organization, 2015, 2022). Economic consequences extend beyond direct healthcare costs to include productivity losses, diminished trade competitiveness, and reduced tourism revenue.

Cambodia exemplifies the complex food safety challenges facing rapidly developing nations. The country has experienced substantial urban population growth, dietary transitions toward increased animal-source food consumption, and expanding participation in regional food trade. These shifts occur against a backdrop of persistent reliance on informal food markets, limited cold-chain infrastructure, and heterogeneous implementation of food safety standards. Cambodia's food environment includes traditional wet markets, street food vendors, small restaurants, and emerging modern retail formats, each presenting distinct food safety risk profiles.

Recent policy developments signal growing governmental prioritization of food safety governance. The 2022 Law on Food Safety established a comprehensive regulatory framework for managing food safety, quality, hygiene, and authenticity across all stages of the production chain (Royal Government of Cambodia, 2022). Complementary regulatory instruments include Prakas 166 on prepared food products (Ministry of Industry and Handicraft, 2018) and Prakas 252 on food hygiene in manufacturing and food service establishments (Ministry of Industry, Science, Technology & Innovation, 2023).

Despite legislative advances, evidence suggests that foodborne illness outbreaks and contamination events remain significant public health concerns. Implementation challenges—including limited inspectorate capacity, insufficient laboratory infrastructure, fragmented surveillance systems, and gaps between regulatory standards and operational practices—constrain translation of policy frameworks into measurable health improvements.

This systematic narrative review aimed to: Characterize the burden and reporting patterns of foodborne disease in Cambodia; Synthesize empirical evidence on key hazards and high-risk foods and settings using a farm-to-fork framework; Analyze the governance and regulatory landscape for food safety; Identify critical gaps in surveillance, laboratory capacity, and program implementation, and propose evidence-informed priority actions and research directions.

2. MATERIALS AND METHODS

2.1 Study design

This study is a systematic narrative review integrating empirical, policy, and legal evidence on food safety in Cambodia. A structured search strategy and predefined eligibility criteria were applied, with descriptive synthesis organized by farm-to-fork stages and governance components.

2.2 Data sources and search strategy

Peer-reviewed literature was identified through searches of PubMed and Google Scholar from database inception to January 2026. The PubMed search string was: (Cambodia[MeSH] OR Cambodia[Title/Abstract]) AND ("food safety"[MeSH] OR "foodborne diseases"[MeSH] OR "food contamination"[MeSH] OR "food microbiology"[MeSH] OR "Salmonella"[MeSH] OR "food hygiene"[Title/Abstract]). The search was executed on January 15, 2026. For Google Scholar, the first 200 results sorted by relevance were screened based on title and abstract for Cambodia focus and food safety relevance. Grey literature and official documents were identified through targeted searches of websites of the World Health Organization Western Pacific Regional Office (www.who.int/westernpacific), Food and Agriculture Organization Regional Office for Asia and Pacific (www.fao.org/asiapacific), Cambodia Ministry of Health (www.moh.gov.kh), Ministry of Commerce (www.moc.gov.kh), and National Institute of Public Health Cambodia (www.niph.org.kh). Search terms included "food safety," "foodborne disease," "surveillance," and "outbreak" in site search functions and document repositories. Key national legal and regulatory instruments, including the Law on Food Safety and implementing Prakas, were obtained in English translation or official English summaries where available.

2.3 Eligibility criteria

Sources were eligible if they: Focused on Cambodia or included Cambodia-specific data within a multi-country study; Reported on foodborne disease burden, outbreak surveillance, microbiological or chemical hazards in foods, food safety governance frameworks, regulatory instruments, laboratory and surveillance capacity, or interventions; Were peer-reviewed articles, technical or research reports, official legal or policy documents, or doctoral theses; Were available in English.

The English-only inclusion criterion may have excluded relevant Khmer-language publications, particularly local surveillance reports and unpublished ministry documents. This language restriction represents a potential bias toward internationally-oriented research and may underrepresent locally-conducted studies.

Opinion pieces without empirical data or substantive policy analysis and documents that did not provide Cambodia-specific information were excluded.

3. RESULTS AND DISCUSSION

3.1 Burden and surveillance of foodborne disease

National surveillance data documented 135 reported foodborne disease outbreaks during 2014–2019, resulting in 5,825 cases and 81 deaths (Ministry of Health Cambodia, 2020; National Institute of Public Health, 2021). Outbreaks were defined as ≥ 2 cases with common exposure and epidemiological linkage, meeting national notification criteria. Laboratory confirmation (culture or PCR) was available for approximately 40% ($n=54$) of reported outbreaks; remaining events were classified based on clinical and epidemiological evidence. Case definitions followed WHO guidelines adapted by Cambodia's National Institute of Public Health. Attribution to specific foods or settings was documented where investigation data were available (72% of outbreaks). These figures likely represent minimum estimates due to limited healthcare access, incomplete laboratory confirmation capacity, and weak linkage between health facilities and surveillance systems. Outbreak narratives describe diverse etiologies, including microbiological contamination, methanol-contaminated alcoholic beverages, and pesticide-contaminated water.

Key surveillance gaps include lack of routine active surveillance for sporadic illness, limited standardization of outbreak investigation protocols, insufficient laboratory capacity for confirmatory testing, incomplete food attribution data, and limited mechanisms for public risk communication (National Institute of Public Health, 2021). These findings align with challenges documented in other Southeast Asian nations, where passive surveillance systems underestimate true disease burden.

3.2 Farm-to-Fork risk assessment

Production stage. At the agricultural production stage, food safety risks arise from documented use of agricultural chemicals without consistent adherence to withdrawal periods (Food and Agriculture Organization, 2020), limited on-farm biosecurity practices, use of contaminated irrigation water, and inadequate treatment of manure (plausible risk factors based on regional patterns documented in neighboring Southeast Asian countries). Climate-related factors, including flooding documented in Cambodia's low-lying agricultural areas, further exacerbate contamination risks (Food and Agriculture Organization, 2020).

Processing and slaughter. Food processing and slaughter facilities range from large commercial operations to small-scale artisanal processors. Common risk factors documented in Cambodia include inadequate separation of clean and contaminated zones, limited availability of potable water in rural processing facilities, insufficient temperature control during storage and processing, and inadequate cleaning and sanitization

of food-contact surfaces (Food and Agriculture Organization, 2020; Ministry of Health Cambodia, 2020).

Distribution and transport. Limited cold storage and refrigerated transport infrastructure, documented in FAO assessments of Cambodia's food supply chain (Food and Agriculture Organization, 2020), result in extended time-temperature exposure conducive to pathogen multiplication. Road infrastructure constraints and urban traffic congestion represent plausible risk factors that lengthen transport times and compromise temperature control; however, systematic time-temperature monitoring data for Cambodian food distribution are not yet available.

Retail markets and food service. Traditional wet markets constitute the predominant retail channel for fresh foods. Infrastructure constraints documented in market assessments (Ministry of Health Cambodia, 2020) include limited access to potable water, inadequate waste management and drainage, absence of temperature-controlled display, and physical layouts facilitating cross-contamination. Street food vendors face similar documented constraints, operating with limited handwashing facilities and minimal refrigeration capacity.

Household food handling. Risks at the household stage include limited domestic refrigeration capacity, intermittent electricity supply (documented challenge in Cambodia's national infrastructure reports), use of unsafe water and ice, cross-contamination during preparation, insufficient cooking temperatures, and unsafe storage practices. Consumer knowledge gaps regarding safe food handling constrain adoption of preventive behaviors.

3.3 Microbiological contamination evidence

Multiple studies document substantial microbiological contamination. A nationwide survey ($n=456$ samples collected 2019–2021 from retail markets nationwide) reported high prevalence of *Salmonella* spp. (45.6% of 180 chicken samples, 32.1% of 158 pork samples) and *Staphylococcus aureus* (67.2% of chicken samples, 51.8% of pork samples) in retail meat products, detected using culture-based methods with serotyping (Chea et al., 2021). Environmental sampling of cutting boards ($n=120$ boards from 40 traditional market stalls, 2020) showed 41.7% *Salmonella*-positive rates using swab-based sampling with enrichment culture, providing direct evidence of cross-contamination pathways.

Recent sampling in Phnom Penh ($n=312$ samples, 2023) detected *Salmonella* spp. in 48.5% of products overall, with highest prevalence in meat (61.5% of 130 samples) and seafood (52.8% of 106 samples), using culture-based detection (Huoy et al., 2024). Antimicrobial resistance profiling revealed concerning patterns, including resistance to critically important

antimicrobials (Lim et al., 2023). Fresh vegetables demonstrate contamination indicative of fecal pollution (n=85 samples of fermented vegetables from local markets, 2016; Chrun et al., 2017), likely reflecting contaminated irrigation water or post-harvest cross-contamination.

The consistent finding of high *Salmonella* prevalence across multiple food categories suggests systematic rather than sporadic contamination, reflecting cumulative effects of inadequate hygiene across production, slaughter, distribution, and retail stages (Chea et al., 2021; Huoy et al., 2024). These prevalence rates substantially exceed those typically reported in high-income settings with mature food safety systems (e.g., *Salmonella* in retail chicken: 5–15% in USA, 8–12% in EU, compared to 45.6% in Cambodia), indicating significant opportunities for intervention. **Table 1** summarizes selected microbiological contamination studies conducted in Cambodia, showing the diversity of hazards, food categories, and contamination rates across different settings.

3.4 Chemical hazards and adulterants

Documented violations. Chemical hazards include pesticide residues in domestically produced and imported produce. FAO reports document specific violations detected in selected commodities during targeted monitoring (Food and Agriculture Organization, 2020). Contributing factors include high application rates, inadequate farmer training, and insufficient residue monitoring. Additional documented hazards include methanol contamination of alcoholic beverages through deliberate adulteration or improper distillation (implicated in multiple outbreak investigations), and antimicrobial residues in animal products detected in limited surveys.

Priority surveillance gaps. Systematic residue data across major food commodities remain limited. Heavy metal contamination in areas with industrial activity represents a plausible risk requiring verification through targeted surveys. Chemical testing requires sophisticated instrumentation and quality systems that remain limited in Cambodia. Expanding laboratory capacity for pesticide, heavy metal, and veterinary drug residue detection is essential, alongside method development, proficiency testing, and personnel training.

3.5 Governance and regulatory framework

The 2022 Law on Food Safety represents Cambodia's most comprehensive legislative framework (Royal Government of Cambodia, 2022), establishing coordinating authority to the Ministry of Commerce, farm-to-fork scope, business registration requirements, incident response provisions, and penalties. Complementary instruments Prakas 166 (Ministry of Industry and Handicraft, 2018) and Prakas 252 (Ministry of Industry, Science, Technology & Innovation, 2023) provide operational

specificity for prepared foods and hygiene requirements. **Table 2** presents the key Cambodian food safety governance instruments that form the current regulatory framework.

Food safety governance involves multiple entities: Ministry of Commerce (coordination), Ministry of Health (surveillance and outbreak investigation), and Ministry of Agriculture, Forestry and Fisheries (agricultural practices and slaughter regulation). Multi-sectoral coordination remains challenging. A One Health framework offers potential for strengthened coordination, particularly for zoonotic pathogens and antimicrobial resistance surveillance (Lim et al., 2023). The 2022 legislation represents substantial governance strengthening (Royal Government of Cambodia, 2022). However, gaps between policy frameworks and operational capacity remain substantial. Similar challenges have been documented in other lower-middle-income countries where legislative frameworks precede implementation capacity development.

3.6 Critical implementation challenges

Cross-cutting implementation gaps include: (1) Surveillance – limited active surveillance, non-standardized outbreak investigation, weak data integration (National Institute of Public Health, 2021); (2) Laboratory capacity – insufficient testing capacity, limited equipment, lack of standardized methods and quality systems; (3) Risk-based inspection – resource constraints limiting coverage, underdeveloped risk categorization tools, enforcement challenges in informal sector; (4) Infrastructure – inadequate WASH facilities, drainage, cold storage in markets; (5) Food handler practices – sporadic training, certification not linked to incentives; (6) Consumer awareness – limited food safety knowledge, underdeveloped risk communication strategies.

These findings underscore that translating legislative authority into health outcomes requires parallel investments in implementation capacity. The predominance of informal food markets necessitates intervention approaches beyond traditional enforcement, combining infrastructure support, practical training, progressive certification, and incentives rather than punitive measures alone.

3.7 Implications for policy and practice

For governmental authorities, this review underscores need for coordinated, sustained investment across surveillance, laboratories, inspection, infrastructure, and behavior change. An integrated, systems approach recognizing interdependencies offers greatest potential for measurable reductions. International development partners should recognize that effective strengthening requires multi-year commitments balancing short-term wins with longer-term institutional development. For researchers, priority should be placed on implementation science

Table 1: Selected microbiological contamination studies in Cambodia.

Hazard	Food category	N	Year / Setting	Method	Prevalence / Finding
<i>Salmonella</i> spp.	Chicken meat	180	2019–2021 / Nationwide markets	Culture, serotyping	45.6% positive (Chea et al., 2021)
<i>Salmonella</i> spp.	Pork	158	2019–2021 / Nationwide markets	Culture, serotyping	32.1% positive (Chea et al., 2021)
<i>Staphylococcus aureus</i>	Chicken meat	180	2019–2021 / Nationwide markets	Culture	67.2% positive (Chea et al., 2021)
<i>Salmonella</i> spp.	Meat (mixed)	130	2023 / Phnom Penh markets	Culture	61.5% positive (Huoy et al., 2024)
<i>Salmonella</i> spp.	Seafood	106	2023 / Phnom Penh markets	Culture	52.8% positive (Huoy et al., 2024)
Coliforms	Fermented veg.	85	2016 / Local markets	Culture enumeration	Elevated counts ($\geq 10^5$ CFU/g, indicative of inadequate hygiene per Codex) (Chrun et al., 2017)

Note: Studies selected based on largest sample sizes and most recent data across multiple food categories.

Table 2. Key Cambodian food safety governance instruments

Instrument	Year	Lead body	Main provisions
Law on Food Safety (Royal Kram NS/RKM/0622/006)	2022	Ministry of Commerce	Comprehensive farm-to-fork food safety law; business registration, incident response, penalties (Royal Government of Cambodia, 2022)
Prakas No. 166 on prepared food products	2018	Ministry of Industry and Handicraft	Control and registration procedures for prepared food products (Ministry of Industry and Handicraft, 2018)
Prakas No. 252 on food hygiene	2023	Ministry of Industry, Science, Technology & Innovation	Hygiene requirements and certification for food establishments (Ministry of Industry, Science, Technology & Innovation, 2023)

Note: These instruments represent the primary legislative and regulatory framework; additional subordinate regulations and ministry-specific technical standards are in development.

and rigorous program evaluation, with attention to cost-effectiveness and equity impacts. The relative paucity of evidence on chemical hazards (Food and Agriculture Organization, 2020) represents a significant knowledge gap requiring targeted residue surveys in high-consumption foods.

3.8 Strengths and limitations

Strengths include comprehensive synthesis of diverse evidence types, farm-to-fork organizational framework, and integration of governance analysis with technical evidence. Limitations include potential selection bias, language bias from English-only inclusion (potentially excluding Khmer-language local studies), heterogeneity in study quality, scarcity of peer-reviewed studies in some domains, substantial underreporting meaning documented figures represent minimum estimates, and geographic concentration of research in Phnom Penh limiting rural generalizability.

CONCLUSION

Food safety represents a substantial but inadequately addressed public health priority in Cambodia. Available evidence documents high microbiological contamination prevalence, significant disease burden, and important implementation gaps despite recent legislative strengthening. Meaningful burden reduction requires coordinated action across multiple domains: strengthened surveillance and outbreak response capacity; expanded laboratory infrastructure for microbiological and chemical hazards; risk-based inspection systems; practical interventions addressing market infrastructure and food handler practices; and multi-sectoral governance coordination operationalizing the farm-to-fork approach articulated in the 2022 Law. A One Health framework integrating human, veterinary, and environmental sectors offers particular promise for addressing zoonotic pathogens and antimicrobial resistance. Regional cooperation within ASEAN can support knowledge exchange, standards harmonization, and joint initiatives. With sustained investment, technical capacity building, and evidence-informed targeting, Cambodia can achieve meaningful reductions in preventable foodborne disease while supporting safe, equitable, and economically viable food systems.

CONFLICT OF INTEREST

The author declares no conflicts of interest.

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ETHICAL APPROVAL

Not applicable. This review utilized only publicly available published literature and policy documents.

AI DECLARATION

The author declares that artificial intelligence (AI) tools were used solely to assist with language editing, grammar refinement, and improvement of clarity and readability. AI tools did not generate original data, analyses, or scientific interpretations. All content was critically reviewed, revised, and approved by the author, who takes full responsibility for the accuracy and integrity of the manuscript.

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