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The role of veterinarians in food safety and public health: A one health approach

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Abstract

Food safety is a fundamental component of public health, economic development, and sustainable food systems. With increasing globalization of food production and distribution, the emergence of antimicrobial resistance (AMR), zoonotic diseases, and foodborne pathogens has intensified the need for effective food safety management. Veterinarians play a critical role throughout the food chain, from animal production and disease prevention to slaughter inspection, residue monitoring, epidemiological surveillance, and public health protection. Their expertise in animal health, food hygiene, zoonoses, and risk assessment positions them as key stakeholders in modern food safety systems. The One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, has further expanded veterinary responsibilities in ensuring safe food production. This paper reviews the multifaceted role of veterinarians in food safety, highlights current challenges, and discusses future opportunities in strengthening food safety systems globally.

Keywords: Food safety, veterinarian, one health, zoonoses, antimicrobial resistance, public health, foodborne diseases, veterinary public health

Introduction

Veterinarians are central to food safety systems worldwide. They bridge animal health, public health, and environmental stewardship, especially under the One Health framework, which recognizes the interconnectedness of human, animal, and environmental health Utomo (2025) ^[1].

1. One Health in Food Safety

One Health is a collaborative, multisectoral approach that optimizes health outcomes by integrating expertise from veterinarians, physicians, ecologists, and other professionals. In food safety, it addresses risks like zoonotic diseases, antimicrobial resistance (AMR), and environmental contamination across the entire supply chain—from production ("farm") to consumption ("fork")

This holistic view shifts focus from reactive responses (e.g., outbreak investigations) to proactive prevention, such as surveillance, biosecurity, and sustainable practices. Veterinarians are uniquely positioned due to their expertise in animal pathology, epidemiology, and food production systems. Shrivastava *et al.*, (2025) ^[2].

2. Veterinary Public Health and Food Safety

Veterinary Public Health (VPH) is defined as the contribution of veterinary science to the physical, mental, and social well-being of humans. Food safety constitutes one of the most important pillars of veterinary public health. Veterinarians contribute by:

1. Preventing zoonotic diseases
2. Monitoring animal health
3. Ensuring hygienic food production
4. Conducting food inspection
5. Managing disease outbreaks
6. Controlling antimicrobial use
7. Monitoring veterinary drug residues
8. Supporting food safety regulations

According to international guidelines, veterinarians are uniquely trained in both animal health and food hygiene, making them central actors in food safety systems. Narayan *et al.*, (2023) ^[3].

3.1 Role of Veterinarians at the Farm Level

3.1 Disease Prevention and Control

Healthy animals produce safer food. Veterinarians implement preventive healthcare programs that reduce disease occurrence in livestock.

Major activities include

- Vaccination programs
- Biosecurity implementation
- Disease diagnosis
- Treatment protocols
- Herd health management
- Parasite control Collett *et al.*, (2020) ^[4].

These measures reduce contamination risks from pathogens such as

- Salmonella spp.
- Campylobacter spp.
- Listeria monocytogenes
- Escherichia coli O157:H7
- Brucella spp.
- Mycobacterium bovis

Effective disease control significantly decreases foodborne illness risks in humans. Zenu and Bekele (2024) ^[5].

3.2 Biosecurity Management

Veterinarians design and monitor farm biosecurity systems.

Key measures include

- Restricted farm access
- Animal quarantine
- Sanitation procedures
- Vector control
- Feed and water quality monitoring

Strong biosecurity prevents the introduction and spread of infectious diseases that may enter the food chain. Jimenez *et al.*, (2023) ^[6].

3.3 Animal Welfare and Food Safety

Animal welfare directly affects food quality and safety.

Stress can lead to

- Increased pathogen shedding
- Immunosuppression
- Reduced product quality

Veterinarians ensure compliance with welfare standards through

- Proper housing
- Humane handling
- Adequate nutrition
- Transportation monitoring

Improved welfare enhances both productivity and food safety. Bassols *et al.*, (2014) ^[7].

4. Veterinarians and Zoonotic Disease Control

Approximately 60% of emerging infectious diseases are zoonotic in origin. Many foodborne pathogens are transmitted from animals to humans.

Examples include

Disease	Causative Agent
Salmonellosis	<i>Salmonella</i> spp.
Campylobacteriosis	<i>Campylobacter</i> spp.
Listeriosis	<i>Listeria monocytogenes</i>
Brucellosis	<i>Brucella</i> spp.
Tuberculosis	<i>Mycobacterium bovis</i>

Veterinarians perform

- Disease surveillance
- Outbreak investigations
- Epidemiological studies
- Vaccination programs
- Public awareness campaigns

These interventions significantly reduce human exposure to zoonotic pathogens. European Food Safety Authority and European Centre for Disease Prevention and Control (EFSA and ECDC) (2018) ^[8].

5. Slaughterhouse Inspection and Meat Safety

One of the most visible food safety roles of veterinarians is meat inspection.

5.1 Ante-Mortem Inspection

Before slaughter, veterinarians assess animals for

- Signs of disease
- Abnormal behavior
- Injury
- Welfare concerns

Animals suspected of illness may be isolated or condemned. Andoni *et al.*, (2023) ^[9].

5.2 Post-Mortem Inspection

Following slaughter, veterinarians inspect

- Carcasses
- Organs
- Lymph nodes
- Internal tissues

Objectives include detection of

- Tuberculosis lesions
- Parasitic infections
- Septicemia
- Tumors
- Contamination

Unsafe meat is removed from the food chain, protecting consumers. Răcășanu *et al.*, (2026) ^[10].

6. Milk Safety and Dairy Hygiene

Milk is highly nutritious but also susceptible to contamination.

Veterinarians contribute to dairy safety through:

- Mastitis control
- Udder health management

- Hygienic milking practices
- Disease surveillance
- Residue monitoring

They also help prevent milk-borne diseases such as

- Brucellosis
- Tuberculosis
- Listeriosis
- Salmonellosis

Regular veterinary supervision ensures safe dairy production. Medeiros *et al.*, (2022) ^[11].

7. Veterinary Drug Residue Monitoring

Improper use of veterinary drugs can leave harmful residues in food products.

Common residues include

- Antibiotics
- Anthelmintics
- Hormones
- Anti-inflammatory drugs

Veterinarians are responsible for

- Prescribing medicines appropriately
- Enforcing withdrawal periods
- Monitoring residue levels
- Educating farmers

Drug residue monitoring protects consumers from

- Allergic reactions
- Toxicity
- Antimicrobial resistance
- Endocrine disruption

Recent studies identify veterinary drug residues as an emerging food safety challenge requiring stronger surveillance systems. Pratiwi *et al.*, (2023) ^[12].

8. Antimicrobial Resistance and Food Safety

Antimicrobial resistance (AMR) is among the most serious threats to global health.

The excessive use of antibiotics in food-producing animals can contribute to the development of resistant bacteria that enter the food chain.

Veterinarians play a critical role in AMR control by:

- Practicing antimicrobial stewardship
- Promoting responsible antibiotic use
- Reducing unnecessary treatments
- Encouraging vaccination
- Improving farm hygiene

Studies indicate that resistant bacteria and resistance genes can spread through food products, emphasizing the need for veterinary oversight. Horvat and Kovačević (2025) ^[13].

9. Food Safety Surveillance and Epidemiology

Veterinarians contribute to national and international surveillance systems by

- Monitoring foodborne pathogens
- Tracking disease outbreaks
- Collecting epidemiological data
- Conducting laboratory investigations

Food safety surveillance enables

- Early detection of outbreaks
- Rapid response measures
- Risk assessment
- Policy development

Veterinary epidemiologists help identify contamination sources and implement control measures. Nemser *et al.*, (2025) ^[14].

10. Veterinarians and HACCP Systems

Hazard Analysis and Critical Control Point (HACCP) systems are internationally recognized food safety management tools.

Veterinarians participate in:

- Hazard identification
- Risk assessment
- Critical control point monitoring
- Verification procedures
- Corrective actions

HACCP implementation significantly reduces foodborne hazards throughout food production. Motarjemi and Warren (2023) ^[15].

11. The One Health Approach and Food Safety

The One Health approach recognizes that human health, animal health, and environmental health are interconnected. Veterinarians are central participants in One Health initiatives because they operate at the interface of these three domains.

Veterinary contributions include

- Zoonotic disease control
- AMR mitigation
- Environmental monitoring
- Food safety surveillance
- Public health education

Modern food safety challenges require multidisciplinary collaboration among veterinarians, physicians, food scientists, environmental experts, and policymakers. Erkyihun and Alemayehu (2022) ^[16].

12. Food Safety in Developing Countries

Developing nations face several challenges:

- Poor infrastructure
- Limited laboratory capacity
- Informal food markets
- Inadequate regulatory enforcement
- Lack of farmer awareness

Veterinarians support improvement through

- Capacity building
- Farmer training
- Community education
- Disease surveillance
- Regulatory enforcement

Integrated food safety networks are increasingly being promoted in countries such as India to strengthen One Health-based public health systems. Butt and Ahmed (2025) ^[17].

13. Emerging Challenges for Veterinarians in Food Safety

Current and future challenges include

13.1 Antimicrobial Resistance

Increasing prevalence of resistant pathogens threatens food safety globally.

13.2 Climate Change

Climate change influences pathogen distribution and food contamination patterns.

13.3 Global Food Trade

International food movement increases risks of transboundary disease spread.

13.4 Emerging Zoonotic Diseases

New pathogens continue to emerge at the animal-human interface.

13.5 Food Fraud and Traceability

Veterinarians increasingly contribute to food authentication and traceability systems.

13.6 Technological Advancements

Use of artificial intelligence, genomic surveillance, blockchain traceability, and rapid diagnostics requires additional veterinary expertise. Fejzić and Šerić-Haračić (2017) ^[18].

14. Future Perspectives

Future veterinary involvement in food safety will focus on

- Precision livestock farming
- Genomic pathogen surveillance
- Digital traceability systems
- Advanced residue detection technologies
- Sustainable livestock production
- Integrated One Health surveillance

Governments and international organizations increasingly recognize veterinarians as essential professionals in achieving global food security and food safety goals.

15. Conclusion

Veterinarians play an indispensable role in ensuring food safety across the entire food production chain. Their responsibilities extend from farm management and disease prevention to slaughter inspection, residue monitoring, antimicrobial stewardship, surveillance, and public health protection. The growing challenges of antimicrobial resistance, emerging zoonotic diseases, globalization, and climate change have expanded the importance of veterinary expertise in food safety systems. Through the implementation of One Health principles, veterinarians help safeguard animal health, human health, and environmental sustainability. Strengthening veterinary services, surveillance systems, and interdisciplinary collaboration will remain essential for achieving safe and sustainable food systems in the future.

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