IPS Journal of Applied Microbiology and Biotechnology
ISSN: 3115-5685
IPS J Appl Microbiol Biotech, 4(4): 237-242 (2025)
DOI: https://doi.org/10.54117/ijamb.v4i4.97

The Intersection of Microbiology and Product Liability Law: Case Studies and Implications

Nwakoby, I. P.[1*], Iheukwumere, I. H.[2*], Iheukwumere, C. M.[3], Nwakoby, N. E.[2], Idigo, M. A.[4] and Ike, V. E.[5]

[1]Department of Private and Public Law, Faculty of Law, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.
[2]Department of Microbiology, Faculty of Natural Sciences, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.
[3]Department of Applied Microbiology & Brewing, Faculty of Biosciences, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.
[4]Department of Biological Sciences, Faculty of Natural Science, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.
[5]Department of Microbiology, University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria.

*Corresponding author e-mail address: ip.nwakoby@coou.edu.ng/ ik.iheukwumere@coou.edu.ng

Abstract

This paper provides a comprehensive analysis of the critical and evolving intersection between microbiology and product liability law. Microbial contamination, whether intentional or accidental, presents a significant risk across numerous industries, including food and beverage, pharmaceuticals, medical devices, and cosmetics. When products contaminated with pathogenic or spoilage microorganisms cause harm to consumers, they trigger complex legal disputes grounded in product liability theories: negligence, strict liability, and breach of warranty. Through an examination of landmark and contemporary case studies, this review illustrates how scientific evidence from microbiology is paramount in establishing causation, defect, and foreseeability—the core pillars of liability. Cases involving *Listeria monocytogenes* in ready-to-eat foods, *Escherichia coli* O157:H7 in fresh produce, and biofilm-forming bacteria on medical implants are dissected to demonstrate the legal challenges and strategies employed. Furthermore, this paper explores the legal implications of emerging microbiological technologies, such as the use of whole-genome sequencing (WGS) for traceback investigations and the liability landscape surrounding probiotics and microbiome-based products. The analysis concludes that effective mitigation of liability risk is inherently dependent on a robust scientific understanding of microbial ecology, pathogenesis, and spoilage mechanisms. It argues for a proactive, prevention-oriented approach, where stringent microbiological quality control, hazard analysis, and clear warning labels are not just regulatory obligations but essential legal safeguards for manufacturers.

Keywords: Product Liability, Microbiology, Foodborne Illness, Pharmaceutical Contamination, Medical Devices, Negligence, Strict Liability, Causation, Whole-Genome Sequencing, Biofilms, Good Manufacturing Practices (GMP), *Listeria*, *E. coli*.

Article History
Received: 26 Sept 2025
Accepted: 15 Oct 2025
Published: 19 Oct 2025

Scan QR code to view•

How to cite this paper: Nwakoby, I. P., Iheukwumere, I. H., Iheukwumere, C. M., Nwakoby, N. E., Idigo, M. A., & Ike, V. E. (2025). The Intersection of Microbiology and Product Liability Law: Case Studies and Implications. *IPS Journal of Applied Microbiology and Biotechnology*, *4*(4), 237–242. https://doi.org/10.54117/ijamb.v4i4.97

1.0 INTRODUCTION

1.1. The Microbial Challenge in Manufacturing

Microorganisms are ubiquitous, adaptable, and remarkably resilient. Their presence in industrial settings is a constant reality, posing a threat to product safety, efficacy, and shelf-life. Microbial contamination can originate from raw materials, water, air, production equipment, or human handlers. Pathogens like *Listeria monocytogenes*, *Salmonella* spp., and *E. coli* O157:H7 can cause severe illness and death, while spoilage organisms can lead to economic loss and brand damage (Iheukwumere *et al*., 2025a; Iheukwumere *et al*., 2025b). Controlling this invisible threat requires a deep understanding of microbial physiology, ecology, and the efficacy of sterilization and preservation techniques (Moorman, 2021; Iheukwumere *et al*., 2025c; Iheukwumere *et al*., 2025d).

1.2. Fundamentals of Product Liability Law

Product liability law governs the liability of manufacturers, distributors, and sellers for injuries caused by defective products. The primary theories under which plaintiffs can bring suit are:

- ✓ **Negligence:** Failure to exercise reasonable care in the product's manufacture, design, or sale.
- ✓ **Strict Liability:** Holding a defendant liable without a need to prove negligence, if the product is shown to be defective and unreasonably dangerous.

- ✓ **Breach of Warranty:** Failure to fulfill the terms of an express or implied promise or guarantee about the product's quality or safety (Restatement (Third) of Torts: Products Liability, 1998).

1.3. Thesis and Scope

This paper argues that microbiology and product liability law are inextricably linked. The resolution of product liability cases often hinges on microbiological evidence to prove fundamental legal elements. By analyzing key case studies across industries, this review will demonstrate how microbial science informs legal outcomes and, conversely, how legal standards compel advancements in microbiological control. Finally, it will outline best practices for manufacturers to mitigate liability in an increasingly complex global market.

2.0 THEORETICAL FRAMEWORK OF PRODUCT LIABILITY

A plaintiff alleging harm from a microbial contaminated product must typically prove: (1) the product was defective, (2) the defect existed when it left the defendant's control, and (3) the defect was the proximate cause of the plaintiff's injury. The legal theory used changes how these elements are framed.

2.1. Negligence

Under negligence, the plaintiff must show the manufacturer breached a duty of care. In microbiology, this translates to a failure to adhere to Good Manufacturing Practices (GMPs), such as inadequate sanitation protocols, failure to validate sterilization cycles, insufficient environmental monitoring, or negligent supplier auditing (Porter, 2019). The question is: did the manufacturer's conduct fall below the standard of a reasonably prudent operator in the same industry?

2.2. Strict Products Liability

Strict liability, as outlined in the Restatement (Second) of Torts § 402A, focuses on the condition of the product itself, not the manufacturer's conduct. A product can be defective in three ways:

- ✓ **Manufacturing Defect:** The product departs from its intended design, even if everything possible was done to prevent it (e.g., a single can in a lot that failed to sterilize properly).
- ✓ **Design Defect:** The inherent design of the product is unreasonably dangerous (e.g., a medical device with crevices that cannot be effectively cleaned and sterilized, promoting biofilm growth).
- ✓ **Failure to Warn (Inadequate Instructions):** The product is dangerous in a way that is not obvious to the user, and the manufacturer failed to provide adequate warnings or instructions for safe use (e.g., not stating that a product must be refrigerated to prevent pathogen growth) (Goldberg, 2019).

2.3. Breach of Warranty

This theory is based on contract law. An express warranty is a specific claim made by the seller (e.g., "sterile," "pathogen-free"). An implied warranty of merchantability guarantees that the product is fit for its ordinary purpose. A bag of salad impliedly warranted to be merchantable should not contain pathogenic bacteria that would render it unfit to eat (White and Summers, 2020; Iheukwumere *et al*., 2025e; Iheukwumere *et al*., 2025f).

3.0 MICROBIOLOGICAL EVIDENCE IN ESTABLISHING LEGAL ELEMENTS

Microbiological data is the linchpin of product liability cases involving contamination.

3.1. Proving Causation: The Microbial "Smoking Gun"

Causation has two components: cause-in-fact and proximate cause. Cause-in-fact is often established using microbiological typing methods. Historically, serotyping and pulsed-field gel electrophoresis (PFGE) were used to match patient and product isolates. Today, Whole-Genome Sequencing (WGS), provides a powerful, high-resolution tool for establishing a genetic match, making it exceedingly difficult for a manufacturer to dispute the source of contamination (Deng *et al.*, 2020). Proximate cause asks if the injury was a foreseeable consequence of the defect. Microbiology helps answer this by establishing the known pathogenicity of the organism and its association with the product type.

3.2. Defining the "Defect": Unreasonably Dangerous Products

The mere presence of a microorganism is not automatically a legal defect. Lactobacillus in yogurt is intended (Iheukwumere *et al*., 2025g; Iheukwumere *et al*., 2025h). The defect is the presence of an unreasonably dangerous microorganism in a product where it is not expected. Expert microbiological testimony is required to explain to a jury why L. monocytogenes in deli meat is a defect, while it is not in a soil sample. This involves explaining virulence factors, infectious dose, and susceptible populations (e.g., immunocompromised individuals) (Iheukwumere *et al*., 2025i; Iheukwumere *et al*., 2025j; Iheukwumere *et al*., 2025k).

3.3. The Role of Foreseeability and State-of-the-Art Defense

A common defense is that the risk was not foreseeable or that the manufacturer used the best available technology ("state-of-the-art" defense). Microbiology is central to this argument. Regulatory guidelines (FDA, USDA), scientific literature, and industry standards define what is foreseeable. A manufacturer is expected to be aware of published risks—for example, the known persistence of *Listeria* in cold, damp environments and its association with certain food types (Iheukwumere *et al*., 2025l; Ekechukwu *et al*., 2025a). Failure to implement controls for such a known hazard is strong evidence of negligence.

4.0 CASE STUDIES IN THE FOOD AND BEVERAGE INDUSTRY

4.1. *Listeria monocytogenes*: The Case of Jensen Farms Cantaloupe (2011)

One of the deadliest foodborne outbreaks in U.S. history was traced to cantaloupe from Jensen Farms, which resulted in 33 deaths. The FDA investigation revealed egregious negligence: the use of outdated, difficult-to-clean potato equipment that harbored *Listeria;* improper water chilling; and a lack of pre-cooling that caused condensation, which sucked bacteria into the fruit's interior (Ekechukwu *et al*., 2025b; Ekechukwu *et al*.,

2025c; Dim *et al*., 2025a). The company principals were charged under the "Park doctrine" (a misdemeanor for responsible corporate officers), and they pleaded guilty. Civil lawsuits were settled for millions. This case is a textbook example of how a failure to understand basic microbial ecology and implement GMPs leads to catastrophic legal consequences (CDC, 2012; DOJ, 2013).

4.2. *E. coli* O157:H7: The Jack in the Box Outbreak (1993)

This outbreak, which sickened hundreds and killed four children, was a watershed moment for the food industry. The cause was undercooked hamburger patties contaminated with *E. coli* O157:H7 (Dim *et al*., 2025b; Dim *et al*., 2025c). Legally, the case involved a critical failure to warn. At the time, the chain complied with existing minimum cooking temperature regulations, but emerging science indicated the pathogen required a higher temperature to be killed (Ike *et al*., 2025a; Ike *et al*., 2025b; Ike *et al*., 2025c). The plaintiffs successfully argued that Jack in the Box was aware of this risk and failed to warn consumers to cook the meat to a higher, safer temperature. The resulting $15.6 million in settlements and the massive reputational damage led to a fundamental overhaul of food safety protocols, including the implementation of HACCP systems industry-wide (Marler, 2008).

4.3. *SALMONELLA* CONTAMINATION: PEANUT CORPORATION OF AMERICA AND CRIMINAL LIABILITY

The PCA case (2008-2009) represents an extreme shift from civil liability to criminal liability. Internal emails showed that management knowingly shipped peanut paste contaminated with Salmonella after retesting products that initially failed quality control until they received a "clean" result (Ike *et al*., 2025d; Ike *et al*., 2025e). This act of knowing and intentional misconduct led to felony convictions for the company owner and several managers. This case established that microbiological fraud—knowingly falsifying safety data—can result in severe criminal penalties, including imprisonment (Flynn, 2015).

5.0 CASE STUDIES IN PHARMACEUTICALS AND MEDICAL DEVICES

5.1. Sterility Failures: The New England Compounding Center Meningitis Outbreak (2012)

The NECC tragedy, which caused 64 deaths and hundreds of infections from contaminated steroid injections, is a prime example of a manufacturing defect compounded by gross negligence. Microbiology revealed that the compounding pharmacy operated in a filthy environment, failed to properly sterilize its products, and ignored multiple signs of contamination (e.g., mold growing in clean rooms) (Ugwu *et al*., 2025a). The company was treated as a manufacturer, not a traditional pharmacy, and was subject to strict liability. The ensuing lawsuits bankrupted the company, and its principal pharmacist was convicted of murder. This case led to significant regulatory changes, granting the FDA more authority over compounding pharmacies (Smith et al., 2019).

5.2. Biofilms on Implants: *Staphylococcus epidermidis* and Joint Replacement Failures

Medical device liability often involves design defects. A classic microbiological problem is biofilm formation on implants. *Staphylococcus epidermidis*, a common skin commensal, can form biofilms on artificial joints, leading to chronic infections and implant failure (Ugwu *et al*., 2025b; Amadi *et al*., 2017). Plaintiffs may argue that the device's design (e.g., a porous surface that is difficult to sterilize or that promotes bacterial adhesion) is inherently defective. Manufacturers must demonstrate that they considered and mitigated this foreseeable risk through material selection, design testing, and clear sterilization instructions for surgeons. Failure to do so can lead to strict liability claims (Arciola *et al*., 2018).

5.3. Contaminated Alcohol Wipes: A Case of Insufficient Preservation

In the early 2010s, a manufacturer of alcohol wipes and swabs recalled products due to contamination with *Bacillus cereus*. The non-sterile wipes contained a preservative system that was supposed to prevent microbial growth (Nwike *et al*., 2017). The contamination led to serious infections. Liability here could be framed as a manufacturing defect (a breach in the production process) or a design defect if the preservative system itself was found to be ineffective at preventing growth of certain spore-forming bacteria. This case highlights the importance of robust preservative efficacy testing (PET) for multi-use, non-sterile products (FDA, 2011).

6.0 EMERGING FRONTIERS AND NOVEL IMPLICATIONS

6.1. The Revolution of Whole-Genome Sequencing (WGS) in Traceback and Litigation

WGS is transforming product liability litigation. Its precision in linking patient, product, and factory environmental isolates strengthens causation arguments tremendously. It can also exonerate innocent companies by demonstrating that their microbial strain is different from the outbreak strain. This technology is setting a new standard for evidence, compelling manufacturers to conduct more sophisticated microbial surveillance of their facilities to be prepared for litigation (Jackson *et al*., 2019; Ekesiobi *et al*., 2025).

6.2. Liability and the Promise of Probiotics and Microbiome-Based Products

This emerging category creates novel liability questions. If a probiotic product contaminated with pathogenic yeast causes fungemia in a hospitalized patient, traditional strict liability applies. However, what if a product contains a claimed "beneficial" strain that, in certain susceptible individuals, causes harm (e.g., bacteremia)? Or what if it fails to deliver its promised health benefit? Liability could stem from a failure to warn about risks to immunocompromised populations or from breach of express warranty regarding specific health claims. The regulatory and legal framework for these live microbial products is still evolving (Sanders *et al*., 2021).

6.3. Cybersecurity Threats: Malicious Manipulation of Microbial Cultures

A futuristic but plausible risk is the cyber-manipulation of fermentation processes or bioreactors. A hacker could alter temperature, pH, or oxygenation parameters to sabotage a batch, leading to microbial contamination and consumer harm. This would raise complex questions of liability: is the manufacturer still liable for failing to secure its industrial control systems, or would liability shift to the malicious actor? This underscores the need for "cyber-biosecurity" as part of a comprehensive risk management plan (Murch *et al.*, 2018).

7.0 RISK MITIGATION AND BEST PRACTICES FOR MANUFACTURERS

The best defense against product liability is a proactive, prevention-oriented offense grounded in sound microbiology.

7.1. Implementing and Documenting Robust GMP and HACCP Plans

Compliance with GMP (21 CFR Part 110, 211) and HACCP is the first line of defense. Meticulous documentation is critical. In court, "if it wasn't documented, it wasn't done." Records of sanitation procedures, employee training, equipment validation, and supplier approvals are vital evidence of due care.

7.2. Environmental Monitoring Programs and Zone Control

A proactive environmental monitoring program (EMP) that tests for pathogens and indicator organisms in the production facility is not just a regulatory tool; it is a legal shield. It demonstrates a commitment to identifying and eliminating hazards before they contaminate the product. Finding *Listeria* on a floor drain (Zone 3) and responding to it prevents a future finding in a product contact surface (Zone 1) that would be disastrous.

7.3. The Critical Importance of Clear Warnings and Instructions for Use

Manufacturers must provide clear, unambiguous instructions for handling, storage, and use. Warnings must be adequate for the foreseeable misuse by a consumer. For example, raw cookie dough must carry warnings about consuming raw flour and eggs due to *Salmonella* and *E. coli* risks. The language must be clear and prominent to successfully invoke the "failure to warn" defense.

8.0 CONCLUSION

The intersection of microbiology and product liability law is a dynamic field where science and jurisprudence continuously inform one another. As demonstrated through numerous case studies, from cantaloupe to compounded drugs, the outcomes of legal battles are profoundly dependent on microbiological evidence to establish defect, causation, and foreseeability. The evolution of science, particularly with tools like WGS, is raising the standard of proof and making it harder for negligent manufacturers to evade responsibility.

Conversely, the threat of significant legal and financial liability has been a powerful driver for the adoption of more rigorous microbiological controls and food safety standards across industries. The lesson for manufacturers is unequivocal: investing in a science-based, meticulously documented microbial safety program is not merely a cost of doing business; it is a critical investment in risk management and brand protection. In the court of law, as in the natural world, ignorance of microbiology is not a viable defense.

REFERENCES

Amadi, R.E., Iheukwumere, I.H. and Unaeze, B.C. (2017). Effects Of Crude Alkaloid Extracted From Ocimum Gratissimum On The Activity Of Ciprofloxacin Against Salmonella Enterica Serovar Typhi. *Advances in Life Science and Technology* 58.

Arciola, C. R., Campoccia, D. and Montanaro, L. (2018). Implant infections: adhesion, biofilm formation and immune evasion. *Nature Reviews Microbiology* 16(7): 397–409.

Centers for Disease Control and Prevention (CDC). (2012). Multistate Outbreak of Listeriosis Linked to Whole Cantaloupes from Jensen Farms, Colorado. Retrieved from [https://www.cdc.gov/listeria/outbreaks/cantaloupes-jensen-farms

Deng, X., den Bakker, H. C. and Hendriksen, R. S. (2020). Genomic epidemiology: Whole-genome-sequencing-powered surveillance and outbreak investigation of foodborne bacterial pathogens. *Annual Review of Food Science and Technology* 11: 353-374.

Department of Justice (DOJ). (2013). Colorado Farm Owners Charged in Connection with Contaminated Cantaloupe that Killed 33. [Press Release]. Retrieved from [https://www.justice.gov/opa/pr/colorado-farm-owners-charged-connection-contaminated-cantaloupe-killed-33]

Dim, C. N., Iheukwumere, I. H., Iheukwumere, C. M., Ugwu, C. H., Ike, V. E., Ezendianefo, . J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., Oduenyi, P. M., & Ochibulu, S. C. (2025a). Multiple Antibiotic Resistance Bacterial Strains in Frozen Meat Sold at Abagana, Anambra State: A Public Health Concern. *IPS Journal of Applied Microbiology and Biotechnology*, *4*(3), 181–186. https://doi.org/10.54117/ijamb.v4i3.75

Dim, C. N., Iheukwumere, I. H., Iheukwumere, C. M., Ugwu, C. H., Ike, V. E., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., Oduenyi, P. M., & Ochibulu, S. C. (2025b). The Burden of Antibiotic Resistance: Evaluating the Impact of Multiple Antibiotic-Resistant Enteric Bacteria in Academic Environments. *IPS Interdisciplinary Journal of Biological Sciences*, *4*(4), 144–149. https://doi.org/10.54117/iijbs.v4i4.78

Dim, C. N., Iheukwumere, I. H., Iheukwumere, C. M., Ugwu, C. H., Ike, V. E., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., Oduenyi, P. M., & Ochibulu, S. C. (2025c). Antimicrobial resistance in aquaculture: evaluating pseudomonas aeruginosa from fish ponds. *IPS Intelligentsia Multidisciplinary Journal*, *4*(1), 32–36. https://doi.org/10.54117/iimj.v4i1.10

Ekechukwu, C. C., Umeh, S. O., Iheukwumere, I. H., & Iheukwumere, C. M. (2025a). Bacterial Loads of Smoked Fish and Chicken: Role of pH and Moisture Content. *IPS Applied Journal of Nutrition, Food and Metabolism Science*, 3(1), 44–49. https://doi.org/10.54117/iajnfms.v3i1.102.

Ekechukwu, C. C., Umeh, S. O., Iheukwumere, I. H., & Iheukwumere, C. M. (2025b). Biological Inhibition of Pathogenic Bacteria Isolated from Smoked Fish and Chicken: An In Vitro Study. IPS Interdisciplinary Journal of Biological Sciences, 4(2), 85–92. https://doi.org/10.54117/iijbs.v4i2.50.

Ekechukwu, C. C., Umeh, S. O., Iheukwumere, I. H., & Iheukwumere, C. M. (2025c). Prophylactic Potential of the Most Potent Synergistic Biological Agent against Bacterial Infections

from Smoked Fish and Chicken. IPS Journal of Applied Microbiology and Biotechnology, 4(2), 153–160. https://doi.org/10.54117/ijamb.v4i2.57.

Ekesiobi, A. O., Iheukwumere, C. M., Iheukwumere, I. H., Ejike, C. E., Ilechukwu, C. C., Ike, V. E., Okereke, F. O., & Ochibulu, S. C. (2025). Hyping the Inhibitory Activity of Xylopia aethiopica against Vibrio cholerae using Azithromycin. IPS Journal of Basic and Clinical Medicine, 2(3), 93–98. https://doi.org/10.54117/ijbcm.v2i3.16

Flynn, D. (2015). Peanut Corporation of America: From Salmonella to Sentencing. Food Safety News.

Goldberg, J. C. P. (2019). The Restatement (Third) of Torts and the Future of Products Liability. *William and Mary Law Review* 60(6): 2163-2190.

Iheukwumere, I. H., Ajeh, J. C., Iheukwumere, C. M., Ike, V. E., Obianom, A. O., Ihenatuoha, U. A. ., Igboanugo, E. U., Onwuasoanya, U. F., Okereke, F. O., Nnadozie, C. H., Agbaugo, C. F., Nwike, M. I., Nwakoby, N. E., & Ilechukwu, C. C. (2025l). Exploring the Phytochemical and Antimicrobial Properties of Fruit Vinegar: A Study on Phoenix Dactylifera and Malus Sylvestris. *IPS Journal of Applied Microbiology and Biotechnology*, 4(1), 115–122. https://doi.org/10.54117/ijamb.v4i1.48

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025a). *Lactobacillus* fermentation of chicken feather: Impact on structural development and immune system of albino Wistar rats. *IPS Applied Journal of Nutrition, Food and Metabolism Science*, *3*(2), 75–83. https://doi.org/10.54117/qabcj082

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025b). Evaluation of *Lactobacillus* fermented chicken feather meal on blood lipoproteins and lymphocyte count in rats. *IPS Journal of Nutrition and Food Science*, *4*(4), 569–577. https://doi.org/10.54117/012d8612

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025c). Exploring the impact of *Lactobacillus*-fermented chicken feather on organ weights and functions in albino Wistar rats. *IPS Journal of Toxicology*, *3*(3), 68–75. https://doi.org/10.54117/zc1h5865

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025d). Corollary of Lactobacillus Fermented Chicken Feather on Organ-Weight and Leukocyte Indices of Broiler Chicks. *IPS Intelligentsia Multidisciplinary Journal*, *4*(1): 46-53. https://doi.org/10.54117/iimj.v4i1.12

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025e). Fermented Chicken Feather Meal as a Potential Feed Supplement: Effects on Body Weight and Immune Function. *IPS Intelligentsia Multidisciplinary Journal*, *4*(1), 37–45. https://doi.org/10.54117/iimj.v4i1.11

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025f). Corollary of Lactobacillus Fermented Chicken Feather on Growth Performance of Rats. *IPS Journal of Biotechnology and Applied Biochemistry*, *1*(2), 57–65. https://doi.org/10.54117/ijbab.v1i2.85

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025g). Corollary of Lactobacillus Fermented Chicken Feather on Growth Performance of Rats. *IPS Journal of Biotechnology and Applied Biochemistry*, *1*(2), 57–65. https://doi.org/10.54117/ijbab.v1i2.85

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025h). Fermented Chicken Feather as a Sustainable Feed Ingredient: Effects on Broiler Chick Health and Growth. *IPS Interdisciplinary Journal of Biological Sciences*, *4*(4), 157–165. https://doi.org/10.54117/iijbs.v4i4.84

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025i). Assessment of Fermented Corn Mixed with Fish Meal as a Chicken Additive for Healthy Broiler Chicks. *Journal of Agriculture, Food Technology and Sustainability*, *2*(1), 60–68. https://doi.org/10.54117/jafts.v2i1.82

Iheukwumere, I. H., Iheukwumere, C. M., Idigo, M. A., & Ezekwueche, S. N. (2025j). Evaluation of Fermented Corn Residue as a Growth Promoter in Broiler Chicken Diets. *Journal of Agriculture, Food Technology and Sustainability*, *2*(1), 69–77. https://doi.org/10.54117/jafts.v2i1.83

Iheukwumere, I. H., Iheukwumere, C. M., Obianom, A. O., Nnadozie, C. H., Okereke, F. O., Onwuasoanya, U. F., … Destiny, E. C. (2025k). Cross-Sectional Study of Major Strains of Salmonella enterica Subspecies Enterica Serovar Typhi among Borehole Used in Uli Community. IPS Journal of Public Health, 5(2), 205–210. https://doi.org/10.54117/ijph.v5i2.40.

Ike, V. E., Iheukwumere, I. H., Iheukwumere, C. M., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., & Ochibulu, S. C. (2025a). Prevalence of Bacillus cereus in Powdered Soybean Sold in Uli Community, Anambra State: A Cross-Sectional Study. *IPS Journal of Basic and Clinical Medicine*, *2*(3), 108–114. https://doi.org/10.54117/ijbcm.v2i3.18

Ike, V. E., Iheukwumere, I. H., Iheukwumere, C. M., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., & Ochibulu, S. C. (2025b). *Bacillus cereus in Uli's cornflour: A prevalence study*. *IPS Journal of Nutrition and Food Science*, *4*(3), 544–548. https://doi.org/10.54117/8btte840

Ike, V. E., Iheukwumere, I. H., Iheukwumere, C. M., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., & Ochibulu, S. C. (2025c). Pathogenic Profile Analysis: In Vitro Screening of Enteric Bacteria from University Dusters. *IPS Journal of Applied Microbiology and Biotechnology*, *4*(3), 187–191. https://doi.org/10.54117/ijamb.v4i3.76

Ike, V. E., Iheukwumere, I. H., Iheukwumere, C. M., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., & Ochibulu, S. C. (2025d). Frozen Fish Pathogens: Antimicrobial Resistance and Public Health Implications. *IPS Interdisciplinary Journal of Biological Sciences*, *4*(4), 138–143. https://doi.org/10.54117/iijbs.v4i4.77

Ike, V. E., Iheukwumere, I. H., Iheukwumere, C. M., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., & Ochibulu, S. C. (2025e). Stream water quality assessment: Antibiotic resistance of Lac-positive enteric bacterial isolates. *Journal of Pollution Monitoring, Evaluation Studies and Control*, *4*(2), 120–125. https://doi.org/10.54117/jpmesc.v4i2.21.2025

Jackson, B. R., Tarr, C. and Strain, E. (2019). Implementation of nationwide whole-genome sequencing for real-time foodborne outbreak surveillance. *Current Opinion in Food Science* 26: 1-7.

Marler, W. (2008). The Jack in the Box E. coli Outbreak: A Changing Culture. Marler Clark Blog.

Moorman, E. (2021). Microbial Contamination Control in Pharmaceutical Manufacturing. Davis Healthcare International Publishing.

Murch, R. S., So, W. K., Buchholz, W. G. and Raman, S. (2018). Cyberbiosecurity: An emerging new discipline to help safeguard the bioeconomy. *Frontiers in Bioengineering and Biotechnology* 6: 39.

Nwike, M.I., Iheukwumere, I.H. and Uneze, B.C. (2017). Effect of Spices, pH and Temperature on the Survival and Multiplication of Staphylococcus aureus in Locally Made Soya Milk Drink. *Journal of Natural Sciences Research* 7(4):1-9

Porter, M. F. (2019). Products Liability: Cases and Materials. West Academic Publishing.

Restatement (Second) of Torts. (1965). American Law Institute.

Restatement (Third) of Torts: Products Liability. (1998). American Law Institute.

Sanders, M. E., Merenstein, D. J., Ouwehand, A. C., Reid, G., Salminen, S., Cabana, M. D. and Lenoir-Wijnkoop, I. (2021). Probiotic use in at-risk populations. *Journal of the American Pharmacists Association* 61(1): 27-35.

Smith, R. M., Schaefer, M. K. and Kainer, M. A. (2019). Fungal infections associated with contaminated methylprednisolone injections. New England Journal of Medicine 380(16), 1598-1609.

U.S. Food and Drug Administration (FDA). (2011). Triad Group issues voluntary nationwide recall of all alcohol prep pads, alcohol swabs, and alcohol swabsticks due to potential microbial contamination [Press Release]. Retrieved from [https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/triad-group-issues-voluntary-nationwide-recall-all-alcohol-prep-pads-alcohol-swabs-and-alcohol

Ugwu, C. H., Iheukwumere, I. H., Iheukwumere, C. M., Ike, V. E., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., Oduenyi, P. M., & Ochibulu, S. C. (2025a). Maternal health and antibiotic resistance: *Klebsiella pneumoniae* isolates analysis. *IPS Journal of Public Health, 5*(3), 290–295. https://doi.org/10.54117/s3tx6v26

Ugwu, C. H., Iheukwumere, I. H., Iheukwumere, C. M., Ike, V. E., Dim, C. N., Ezendianefo, J. N., Egbe, P. A., Oragwu, I. P., Orji, C. C., Ogbonnaya, O. C., Onwuasoanya, U. F., Okereke, F. O., Oduenyi, P. M., & Ochibulu, S. C. (2025b). Ocimum gratissimum Extract's Effectiveness against Vibrio cholerae from Uli Streams. *IPS Journal of Phytochemistry and Medicinal Plant Research*, *1*(2), 15–19. https://doi.org/10.54117/ijpmpr.v1i2.38

White, J. J. and Summers, R. S. (2020). Uniform Commercial Code. West Academic Publishing.

.

•*Thank you for publishing with us.*