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Consumer Protection and Harmful Food Adulteration in India: A Study of Legal Remedies and the Role of Forensic Science in Ensuring Food Safety

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Abstract

Food adulteration remains a critical threat to public health and consumer welfare in India, despite the existence of comprehensive laws such as the Food Safety and Standards Act, 2006 (FSSA) and the Consumer Protection Act, 2019 (CPA). Adulterated or substandard food continues to enter the market, exposing gaps in enforcement, laboratory capacity, and consumer awareness. This study examines how effectively India's legal framework safeguards consumers against harmful adulteration and how forensic science particularly forensic chemistry and toxicology can strengthen detection, enforcement, and adjudication mechanisms.

While conventional food testing identifies routine adulterants, advanced forensic methods like chromatography, spectroscopy, and toxicological profiling can reveal hidden contaminants and quantify their risk to human health. These techniques enhance the evidentiary credibility of analytical reports, making them vital in both regulatory and judicial processes. A significant development in this context is the 2025 notification of the Food Safety and Standards Authority of India (FSSAI), designating the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory under Section 43(2) of the FSSA. This reform formally integrates forensic toxicology and chemistry into India's food safety enforcement hierarchy, allowing forensic laboratories to conduct confirmatory testing with statutory finality under Section 46(4).

Adopting a multidisciplinary approach that combines doctrinal legal analysis, case studies, and forensic science perspectives, this research evaluates the interaction between statutory provisions, enforcement practices, and scientific evidence. It identifies systemic limitations in laboratory accreditation, procedural coordination, and evidentiary standards, while recommending stronger integration of forensic science within the regulatory architecture.

Ultimately, the study underscores that effective consumer protection against food adulteration requires not only robust laws but also forensic-driven enforcement, institutional coordination, and adherence to scientific precision ensuring food safety as an integral component of the constitutional right to life under Article 21.

Keywords: Food Adulteration; FSSAI; Right to Safety; Consumer Protection; Forensic Science.

1. INTRODUCTION

Food safety is a cornerstone of public health and consumer protection. In India, food adulteration has long been recognized as a pervasive and complex problem that endangers human life, erodes consumer trust, and undermines the credibility of the food industry. Adulteration typically involves the deliberate addition or substitution of inferior, harmful, or non-permissible substances in food products for economic gain. Such practices compromise nutritional value, introduce toxic contaminants, and pose serious risks to health, particularly among vulnerable populations such as children and the elderly.

The legal foundation for food safety in India rests primarily on the Food Safety and Standards Act, 2006 (FSSA), which consolidated multiple earlier laws into a unified regulatory framework. The Act established the Food Safety and Standards Authority of India (FSSAI) as the apex body responsible for setting national standards, licensing, inspection, and enforcement. Complementing this, the Consumer Protection Act, 2019 (CPA) empowers consumers to seek remedies against unsafe food, misleading claims, and defective products through a three-tier redressal mechanism. Together, these statutes aim to ensure that food reaching consumers is safe, hygienic, and accurately represented.

However, despite this comprehensive legal framework, food adulteration persists on a large scale. Routine analytical methods often detect only superficial adulteration, leaving more complex and trace-level contaminants undetected. This limitation has amplified the need for forensic science, particularly forensic chemistry and toxicology, which employ advanced analytical instruments such as gas chromatography, mass spectrometry, and atomic absorption spectrometry to uncover concealed adulterants, quantify their toxicity, and establish scientific causation in health-related disputes.

A significant development in this regard is the 2025 notification issued by the Food Safety and Standards Authority of India (FSSAI), which designates the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory under Section 43(2) of the FSSA. This notification represents a landmark step in integrating forensic science into statutory food safety enforcement. It authorizes NFSU to perform confirmatory testing in disputed cases using advanced forensic methodologies, with reports issued by such referral laboratories deemed final and conclusive evidence under Section 46(4) of the Act. This formal recognition of forensic toxicology and chemistry elevates scientific analysis from a supportive role to a decisive legal instrument in food safety governance.

Accordingly, this research seeks to explore the extent to which India's consumer protection and food safety laws effectively safeguard the public from harmful food adulteration and how the integration of forensic science enhances enforcement efficiency and evidentiary reliability. By combining doctrinal legal analysis with forensic and regulatory perspectives, the study aims to identify systemic gaps, assess the evolving evidentiary standards under the Bharatiya Sakshya Adhiniyam, 2023, and propose reforms for stronger forensic integration in India's food safety framework.

2. LEGAL FRAMEWORK GOVERNING CONSUMER RIGHTS OVER FOOD ADULTERATION

Food safety forms the foundation of public health and consumer protection in India. With a vast and diverse food industry, ensuring the integrity of food products is both a regulatory and scientific challenge. Adulteration not only threatens human health but also undermines consumer trust in the marketplace. To address these challenges, India has established a robust multi-layered legal framework combining food-

specific legislation, consumer protection law, and criminal accountability. The Food Safety and Standards Authority of India (FSSAI) stands at the centre of this system, while courts, consumer commissions, and accredited laboratories collectively ensure enforcement and redress.

1. **Statutory Foundations: FSSA and CPA**

The Food Safety and Standards Act, 2006 (FSSA) is the primary legislation governing food regulation in India. It consolidates earlier food laws and empowers the FSSAI to set national standards, license food businesses, and regulate manufacturing, storage, distribution, and sale. Section 4 establishes the FSSAI as the apex authority, and Section 16 enumerates its powers to frame regulations, oversee inspections, and accredit laboratories. Section 18 emphasizes the principles of risk assessment, transparency, and consumer safety in all FSSAI decisions. The authority also aligns national standards with international benchmarks such as the Codex Alimentarius, ensuring harmonization in global trade and domestic safety.[3]

Complementing this is the Consumer Protection Act, 2019 (CPA), which directly empowers consumers against unsafe food and misleading advertisements. Through the introduction of product liability provisions (Sections 82–87), the Act makes manufacturers, sellers, and service providers accountable for harm caused by defective or adulterated food. Its three-tier redressal mechanism District, State, and National Consumer Commissions ensures accessible remedies at multiple levels. Consumers can claim compensation, demand product recalls, and initiate corrective advertising, making the CPA a civil counterpart to the FSSA's regulatory enforcement. Together, these statutes create both preventive and compensatory safeguards against food adulteration[4].

The CPA's framework also benefits from forensic integration. Reports from FSSAI-notified laboratories, including forensic institutions, can be filed as expert evidence under Section 113 of the Bharatiya Sakshya Adhiniyam, 2023, strengthening consumer claims with scientific proof of contamination or harm.

2. **Integration of Forensic Laboratories under the FSSAI Framework (Post-2025 Notification)**

In a landmark development, the FSSAI issued a notification on 29 August 2025 under Section 43(2) of the FSSA designating the National Forensic Sciences University (NFSU), Gandhinagar as a Referral Food Laboratory (Registration No. 26/R/FSSAI/2025). This amendment marks a critical step in integrating forensic chemistry and toxicology within India's food safety enforcement hierarchy.[5]

Referral Food Laboratories are statutorily responsible for analyzing "appeal samples" when disputes arise regarding primary test results. With NFSU's recognition, contested or complex adulteration cases such as those involving synthetic dyes, heavy metals, or pesticide residues can now be examined using advanced forensic instrumentation including GC-MS, LC-MS/MS, ICP-MS, FTIR, and DNA barcoding. These laboratories operate under ISO/IEC 17025 accreditation norms, ensuring both scientific validity and legal admissibility.

Under Section 46(4) of the FSSA, the report of a Referral Laboratory is final and conclusive evidence of the facts stated therein. Hence, NFSU's reports now possess statutory finality and carry the same evidentiary weight as government forensic science laboratory findings in criminal trials. The 2025 notification therefore operationalizes the convergence of regulatory science and forensic justice, ensuring that food adulteration is established through forensic precision and not merely routine analysis.

[3] Food Safety and Standards Act, No. 34 of 2006 (India).
[4] Consumer Protection Act, No. 35 of 2019, § 2(9) (India).
[5] Food Safety and Standards Authority of India, Notification S.O. 97(E), Recognising National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory (Aug. 29, 2025), https://fssai.gov.in/upload/notifications/2025/08/68b18c0fca5c5265787%20Lab%20Notification.pdf.

3. **FSSA: Food Analysts, Forensic Experts, and Evidentiary Value**

Section 46 of the FSSA mandates that samples collected during inspections be analysed by officially notified and accredited laboratories to ensure reliability and admissibility in proceedings. Traditionally, these analyses were confined to routine food chemistry and microbiology. However, with the inclusion of NFSU as a Referral Food Laboratory, forensic toxicology and chemistry have now become a formal extension of this process.

This integration allows authorities to confirm adulteration involving industrial chemicals, carcinogenic dyes, or neurotoxic residues substances that standard food analysts may not be equipped to detect. The linkage between Section 43 (laboratory recognition) and Section 46 (sample analysis) strengthens enforcement by guaranteeing that only scientifically validated and NABL-accredited labs can issue reports capable of standing in court.

4. **The Bharatiya Nyaya Sanhita, 2023 (BNS) – Criminal Liability**

The Bharatiya Nyaya Sanhita, 2023 (BNS) replaces the Indian Penal Code and retains offences relevant to food adulteration. Section 273 penalizes adulteration of food or drink intended for sale, while Section 274 criminalizes the sale of noxious or harmful food and drink. Both prescribe imprisonment and fines, treating adulteration as a public-health offence.

By embedding these offences within the new criminal code, the BNS modernizes terminology while reinforcing deterrence. When read alongside the FSSA's enforcement provisions (Sections 50–69), it ensures dual accountability administrative and criminal so that offenders face both regulatory penalties and penal consequences.

5. **The Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS) – Procedure and Chain of Custody**

The Bharatiya Nagarik Suraksha Sanhita (BNSS) complements these substantive provisions by codifying procedural safeguards crucial for evidence integrity.

Sections 176–182 lay down procedures for seizure, sample collection, and preservation.

Sections 349–352 govern expert examination, submission of reports, and handling of scientific evidence in court.

Applied to food adulteration cases under the FSSA, these provisions ensure a continuous chain of custody from sampling to laboratory testing. They prevent tampering, specify how sealed samples must be transported, and prescribe how expert reports are to be filed and authenticated. This procedural consistency enhances the credibility of forensic reports issued by referral laboratories such as NFSU and minimizes grounds for evidentiary challenge during trial.

6. **The Bharatiya Sakshya Adhiniyam, 2023 (BSA) – Evidentiary Standards**

Replacing the Indian Evidence Act, 1872, the BSA modernizes evidentiary law to include digital, scientific, and expert materials.

Section 113 (Expert Opinion) explicitly recognizes expert reports as admissible when the matter involves scientific or technical knowledge. Forensic chemists and toxicologists qualify under this section, enabling their analyses to directly inform judicial conclusions about adulteration.

Section 63 establishes a presumption of authenticity for scientific documents generated by accredited laboratories, such as FSSAI-recognized referral labs.

Section 128 provides that the reports of government scientific experts may be admitted in evidence without the necessity of oral testimony unless the court orders otherwise.

Read together with Section 46(4) of the FSSA, these provisions confer conclusive evidentiary value upon reports from laboratories like NFSU. The synergy between the FSSA and BSA eliminates ambiguity about

admissibility and ensures that forensic findings translate seamlessly into enforceable legal proof.

7. **The Role of the FSSAI as Apex Regulatory Authority**

Under Section 16 of the FSSA, the FSSAI functions as the apex body for setting national food standards, accrediting laboratories, and coordinating enforcement with state authorities. At the state level, Designated Officers and Food Safety Commissioners oversee licensing, inspections, and prosecutions under Sections 29–30, ensuring uniform yet localized implementation.

Following the 2025 notification, FSSAI's laboratory network now includes forensic-capable referral facilities, expanding the reach of scientific enforcement. This ensures that complex adulteration cases receive a higher level of analytical scrutiny and that prosecution relies on validated forensic evidence. The authority's dual mandate regulation and consumer awareness further aligns with its duty to protect the public under Article 21 of the Constitution, which guarantees the right to life and health.

India's food safety enforcement has been transformed into a science-backed legal framework through the integration of key laws FSSA, BSA, BNS, and BNSS. This system ensures that food adulteration is addressed with forensic precision at every stage, from evidence collection to prosecution. The 2025 FSSAI notification and new procedural codes further strengthen this approach by recognizing NFSU as a Referral Food Laboratory and embedding forensic chemistry and toxicology into enforcement. As a result, food testing now supports judicial processes, enhancing prosecution success and protecting the constitutional right to safe food under Article 21.

3. CONSUMER PROTECTION MECHANISMS

Consumer protection in food safety is rooted in the right to safe and wholesome food under Article 21 of the Constitution, reinforced by the Food Safety and Standards Act, 2006 (FSSA) and the Consumer Protection Act, 2019 (CPA). While the FSSA ensures preventive regulation of food quality, the CPA provides a remedial framework through its three-tier redressal system and the principle of product liability, holding manufacturers and sellers accountable for adulterated goods. However, consumers continue to face procedural and evidentiary challenges in proving food contamination due to limited access to accredited laboratories and delays in obtaining standardized test results. Consequently, the role of forensic science has become vital in providing credible, scientifically validated evidence to support consumer claims and strengthen the enforcement of food safety rights.[6]

In this context, a significant regulatory development occurred with the notification issued by the Food Safety and Standards Authority of India (FSSAI) in August 2025, designating the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory under Section 43(2) of the FSSA (Registration No. 26/R/FSSAI/2025). This amendment formally integrates forensic chemistry and toxicology into India's statutory food testing network. NFSU's inclusion represents a major advancement in enforcement and consumer protection, as the institution possesses the capability to conduct confirmatory analyses using advanced forensic instrumentation such as gas chromatography–mass spectrometry (GC–MS), liquid chromatography–mass spectrometry (LC–MS/MS), inductively coupled plasma optical emission spectroscopy (ICP–OES), and Fourier transform infrared (FTIR) spectroscopy. These methods enable precise detection of sophisticated adulterants, including pesticide residues, heavy metals, and synthetic dyes, which routine food analysis might fail to identify.

Under Section 46(4) of the Food Safety and Standards Act (FSSA), a certificate issued by a Referral Food

[6] Protection of Consumers and Food Safety in India, 5 Indian J. Legal Rev. 10 (2025), https://ijlr.iledu.in/wp-content/uploads/2025/01/V5I210F.pdf.

Laboratory is treated as final and conclusive evidence, giving forensic reports from NFSU binding evidentiary value before courts and consumer commissions. This reform effectively bridges the gap between scientific detection and legal adjudication, ensuring that forensic findings are not merely advisory but legally enforceable unless procedurally challenged. The Bharatiya Sakshya Adhiniyam, 2023 (BSA) further reinforces this by recognizing expert scientific opinions under Section 113, presuming authenticity of accredited lab records under Section 63, and permitting acceptance of government expert reports under Section 128 without mandatory court appearance. Complementing this, the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS) upholds procedural integrity through chain-of-custody safeguards in Sections 176–182 and 349–352, ensuring that forensic food samples remain sealed, traceable, and legally reliable throughout regulatory and judicial proceeding.

Despite significant progress, challenges remain in ensuring equitable consumer protection. Many consumers, especially in rural areas, are unaware of their rights or lack access to affordable forensic testing. Though the Consumer Protection Act (CPA) enables e-filing and simplified procedures, limited coordination between consumer forums and FSSAI enforcement authorities often leads to inconsistent or duplicated proceedings[7]. The 2025 FSSAI notification designating the National Forensic Sciences University (NFSU) as a Referral Food Laboratory offers a crucial opportunity to bridge this gap by integrating scientific findings into both regulatory and consumer adjudication processes. Supported by the evidentiary provisions of the Bharatiya Sakshya Adhiniyam (BSA) and procedural safeguards of the Bharatiya Nagarik Suraksha Sanhita (BNSS), forensic reports now possess recognized legal authority. This convergence of law and science strengthens consumer trust, accelerates justice, and reinforces the constitutional right to safe and wholesome food as an inseparable element of the right to life.

4. CHAPTER 4: FORENSIC SCIENCE IN FOOD SAFETY

Forensic science has become a vital pillar of modern food safety enforcement in India. Detection of adulteration now extends beyond routine testing to employ advanced forensic techniques such as GC–MS, LC–MS/MS, AAS, and ICP–OES, enabling the identification of minute traces of heavy metals, pesticides, and industrial chemicals. Forensic chemistry and toxicology together reveal the nature, source, and physiological effects of harmful contaminants, transforming food analysis into a precise scientific discipline[8].

A major milestone was the 2025 FSSAI notification designating the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory under Section 43(2) of the Food Safety and Standards Act (FSSA)[9]. Under Section 46(4), reports from such laboratories are deemed final and conclusive evidence, giving forensic findings high evidentiary weight before courts and consumer commissions. This institutional reform embeds forensic toxicology and chemistry within India's food enforcement structure, ensuring both scientific reliability and legal finality.

The framework aligns with the Bharatiya Sakshya Adhiniyam (BSA), 2023, which recognizes expert opinions and government lab reports as admissible under Sections 113 and 128, and with the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, which safeguards the chain of custody through detailed

[7] Food Safety Standards and Consumer Rights in India: Legal Protections and Regulatory Mechanisms, LawBlend, May 10, 2025, https://lawblend.com/articles/food-safety-standards-and-consumer-rights/

[8] Food Safety and Standards Authority of India, *Introduction to Standard Analytical Methods of FSSAI*, https://www.scribd.com/document/690960704/Introduction-to-Standard-Analytical-Methods-of-FSSAI

[9] FSSAI Notifies Two New Referral Labs, *TaxGuru*, Aug. 29, 2025, https://taxguru.in/corporate-law/fssai-notifies-two-new-referral-labs.html

procedures for seizure, sealing, and examination of samples. Together, these laws uphold the integrity and admissibility of forensic evidence.

The integration of NFSU into the enforcement chain bridges the gap between regulators and forensic experts, enabling faster, scientifically grounded adjudication of food adulteration cases. By linking scientific certainty with legal accountability, forensic science has redefined consumer protection in India, ensuring that both preventive and remedial measures rest on verified scientific truth and procedural justice.

5. CHAPTER 5: ENFORCEMENT AUTHORITIES AND REGULATION

The Food Safety and Standards Authority of India (FSSAI), established under the Food Safety and Standards Act, 2006 (FSSA), serves as the apex regulatory body for ensuring food safety and quality nationwide. It formulates regulations, sets standards, issues licenses, and coordinates with state authorities. Enforcement at the state level is executed by Food Safety Commissioners, Designated Officers, and Food Safety Officers, who conduct inspections, collect samples, and prosecute violations. Together, these agencies ensure that all food produced, stored, and sold in India complies with prescribed safety norms.

The reliability of food safety regulation in India hinges on accurate scientific analysis. Under the Food Safety and Standards Act, 2006 (FSSA), suspected samples are first tested by a Primary Food Laboratory under Section 43(1), and if disputed, re-examined by a Referral Food Laboratory under Section 43(2), whose findings are final and conclusive as per Section 46(4). A major reform came with the August 2025 FSSAI notification designating the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory. This integration strengthened the forensic dimension of food safety enforcement, enabling confirmatory testing through advanced techniques such as GC–MS, LC–MS/MS, and ICP–OES, and ensuring that scientifically validated forensic reports now serve as authoritative evidence in disputed adulteration cases.

The recognition of NFSU as a Referral Food Laboratory ensures that enforcement agencies receive scientifically sound and legally defensible reports. Samples analyzed at NFSU follow strict chain-of-custody protocols in line with the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, which regulates the collection, sealing, and transfer of evidence (Sections 176–182, 349–352), thereby preventing tampering or loss of evidentiary value. The Bharatiya Sakshya Adhiniyam (BSA), 2023 further strengthens the admissibility of such reports Section 128 allows government laboratory findings to be accepted in evidence without the expert's presence, and Section 113 formally recognizes expert opinion as admissible proof. Together, these provisions enhance procedural efficiency and establish forensic reports from NFSU as conclusive, credible evidence in food safety prosecutions and consumer redressal proceedings.

The FSSAI coordinates national food safety enforcement through a network of state commissioners and designated officers responsible for sampling, prosecution, and compliance. It also oversees laboratory accreditation, training, and audits while collaborating with institutions like NFSU, CFTRI, and the Export Inspection Council to promote science-based enforcement. Persistent challenges such as limited skilled analysts, uneven infrastructure, and procedural delays have hindered efficiency[10]. The inclusion of NFSU as a referral laboratory addresses these gaps by providing advanced forensic testing and expert analysis capable of withstanding judicial scrutiny. India's food safety framework now reflects a convergence of law and forensic science, supported by the FSSA, BSA, and BNSS, ensuring evidence-based, transparent, and legally credible enforcement. This integration strengthens regulatory integrity and fulfils the

[10] Micro trace, *Food Forensics — Food Contaminant Testing, Analysis, and Sourcing*, Microtrace LLC, (last visited Nov. 12, 2025).

constitutional mandate under Article 21 to safeguard public health through access to safe, uncontaminated food.

6. CHAPTER:6 CODEX ALIMENTARIUS AND INDIA'S FOOD SAFETY STANDARDS: A COMPARATIVE PERSPECTIVE

Global food safety regulation is increasingly shaped by science-based standards established by the Codex Alimentarius Commission (CAC), created by the FAO and WHO to harmonize international food norms and protect consumer health. Although Codex standards are not legally binding, they form the foundation for national regulations under the WTO's SPS Agreement. In India, the Food Safety and Standards Authority of India (FSSAI), under the Food Safety and Standards Act, 2006 (FSSA), mirrors this approach by integrating risk assessment, scientific testing, and consumer protection. Both Codex and FSSAI emphasize evidence-based regulation and transparency, but India's framework additionally addresses domestic challenges such as the unorganized food sector, informal markets, and region-specific patterns of adulteration.[11]

While the Codex Alimentarius Commission focuses on setting international standards, the FSSAI serves as both a regulatory and operational body, responsible for enforcement, licensing, and adjudication under the Food Safety and Standards Act, 2006 (FSSA). To match Codex's science-based precision, India has increasingly integrated forensic science into its food safety framework. A key milestone was the August 2025 FSSAI notification designating the National Forensic Sciences University (NFSU), Gandhinagar, as a Referral Food Laboratory under Section 43(2) of the FSSA. Using advanced instruments, NFSU now detects complex adulterants such as heavy metals and synthetic dyes, with its reports carrying final evidentiary value under Section 46(4). This integration bridges the gap between standard-setting and scientific enforcement, aligning India's food safety governance with Codex's global, evidence-based model.[12]

Both Codex Alimentarius and India's FSSAI emphasize risk-based regulation through assessment, management, and communication. India has further advanced this model by adding a fourth dimension—forensic verification—through its collaboration with the National Forensic Sciences University (NFSU), where scientific testing confirms adulteration and non-compliance with factual precision. This integration ensures that enforcement is grounded in verifiable evidence, enhancing transparency and consumer confidence. The Bharatiya Sakshya Adhiniyam (BSA), 2023, and the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, reinforce this approach by safeguarding authenticity, chain of custody, and evidentiary admissibility of forensic reports. Together, these reforms align India's food safety governance with Codex's global standards of scientific rigor, traceability, and documentation, marking a shift toward a fully evidence-based, internationally harmonized regulatory system.

India's food safety enforcement faces unique challenges due to diverse production systems, limited regulatory awareness, and the dominance of small-scale enterprises, unlike many Codex member nations with advanced infrastructure. While Codex sets global standards, India's FSSAI has adapted them to local realities by integrating forensic science and strengthening laboratory accreditation. Increased participation in Codex committees has further aligned India with international best practices. The 2025 FSSAI–NFSU

[11] FAO/WHO Codex Alimentarius Commission, *Policy and Legal Frameworks: Codex Alimentarius* (Food & Agriculture Org./World Health Org.).
[12] Food Safety and Standards Authority of India (FSSAI), *Codex Alimentarius Commission (CAC) – India Membership and Role*, https://www.fssai.gov.in/cms/codex.php.

notification, designating the National Forensic Sciences University as a Referral Food Laboratory, symbolizes this commitment to scientific modernization and global harmonization. This hybrid model blends Codex's science-based principles with domestic forensic enforcement, transforming food safety regulation into a system driven by evidence and legal precision. It reinforces consumer protection, enhances India's credibility in global food trade, and upholds the constitutional right to safe and wholesome food.

7. CHAPTER :7 CASE STUDIES ON FOOD ADULTERATION IN INDIA: THE GROWING ROLE OF FORENSIC SCIENCE IN ENFORCEMENT

The study of landmark food adulteration cases in India reveals the persistent challenges in ensuring food safety and the evolving role of forensic science in identifying, proving, and adjudicating such offences. Each case demonstrates how scientific investigation has increasingly become central to consumer protection and regulatory enforcement. Forensic chemistry and toxicology have played a crucial role in establishing the presence of adulterants, quantifying their harmful effects, and linking analytical findings to statutory violations under the Food Safety and Standards Act, 2006 (FSSA).

One of the most widely discussed cases of food adulteration in India was the **Maggi Noodles Controversy (Nestlé India Ltd. v. FSSAI, 2015)**. In this case, samples of Maggi noodles were found by the Uttar Pradesh Food Safety Department to contain excessive levels of lead and monosodium glutamate (MSG). Subsequent testing by different laboratories produced inconsistent results, creating confusion and public distrust. The absence of standardized testing protocols and uniform laboratory accreditation led to conflicting interpretations. Eventually, the Bombay High Court set aside the nationwide ban, citing procedural lapses in testing and lack of conclusive scientific evidence. This case highlighted the urgent need for scientifically accredited laboratories, standard methods of analysis, and expert interpretation of results—gaps that the recent integration of forensic laboratories such as the National Forensic Sciences University (NFSU) now aims to fill.

In 2014, Maharashtra's Food Safety Department uncovered large-scale **adulteration of turmeric with lead chromate**[13], an industrial pigment illegally added to enhance colour. Forensic analysis using atomic absorption spectrometry and ICP–OES confirmed **lead concentrations exceeding 2,000 µg/g**, far above the **FSSAI's permissible limit of 10 µg/g**. Forensic toxicology established that the contaminated turmeric posed severe health hazards, including neurological, renal, and carcinogenic risks. Based on these findings, enforcement authorities ordered the recall of adulterated products, initiated prosecutions, and intensified state-wide surveillance. The case highlighted the essential role of forensic chemistry and toxicology in quantifying toxic adulterants and informed later reforms, including the 2025 FSSAI notification recognizing the National Forensic Sciences University (NFSU) as a Referral Food Laboratory, ensuring standardized forensic verification in future food safety investigations.

In **PepsiCo India Holdings Pvt. Ltd. v. State of Punjab (2019)**, allegations of pesticide residues in soft drinks required advanced forensic verification. The Punjab laboratory's initial findings were disputed, leading to confirmatory testing that demonstrated pesticide levels within permissible limits. The court's decision relied substantially on forensic reports generated through chromatography and mass spectrometry. This case reinforced that enforcement must be guided by validated scientific analysis rather than assumptions, and that forensic laboratories play a decisive role in ensuring fairness and credibility in

[13] Lead Found in Turmeric," Stanford Report (Sept. 17, 2019), https://news.stanford.edu/stories/2019/09/lead-found-turmeric

adjudication.[14]

In 2005, Indian food safety authorities detected **Sudan Red**[15], a banned industrial dye with carcinogenic properties, in chili powder and chili-based products. Spectroscopic and chromatographic analyses confirmed the presence of Sudan I and II compounds, with dye concentrations far exceeding permissible safety limits. Based on these forensic findings, enforcement agencies ordered nationwide recalls, import bans, and penalties against manufacturers under the Prevention of Food Adulteration Act. The incident underscored the pivotal role of forensic chemistry and toxicology in verifying adulteration, guiding enforcement action, and protecting consumers from toxic food additives. It also laid the groundwork for stronger laboratory surveillance later reinforced under the Food Safety and Standards Act, 2006, and the 2025 FSSAI–NFSU forensic integration framework.

In the landmark **Milk Adulteration PIL — *Centre for Public Interest Litigation v. Union of India* (2011)**[16], the Supreme Court exposed large-scale adulteration of milk across India, where samples contained detergents, starch, urea, and synthetic compounds. Forensic chemical and toxicological analyses confirmed these adulterants and proved their severe health risks, including organ and digestive damage. Relying on this scientific evidence, the Court ordered the Union and State Governments to strengthen food-testing laboratories, enforce the Food Safety and Standards Act, 2006, and conduct public awareness programs.[17] The judgment established a precedent for integrating forensic science into food safety regulation, paving the way for later institutional reforms such as the 2025 FSSAI–NFSU notification on forensic laboratory integration

RECOMMENDATIONS

1. **Institutionalizing Forensic Integration within FSSAI:**

The recent 2025 FSSAI notification recognizing the National Forensic Sciences University (NFSU) as a Referral Food Laboratory should be expanded into a nationwide network of accredited forensic laboratories. Each state should establish at least one FSSAI–Forensic Coordination Unit responsible for scientific verification of high-risk food samples and periodic random testing.

2. **Standardization of Analytical Protocols:**

Uniform forensic testing methods, validated through ISO/IEC 17025 accreditation, must be made mandatory for all food testing laboratories. Forensic chemists and toxicologists should follow standardized analytical protocols to ensure consistency and admissibility under Sections 46(4) and 47 of the FSSA and Sections 61–63 of the Bharatiya Sakshya Adhiniyam, 2023 (BSA).

3. **Creation of a National Forensic Food Database:**

Establishing a centralized digital repository for laboratory findings, sample analysis reports, and forensic interpretations will promote transparency and enable cross-verification of results. This database should be securely managed by FSSAI in collaboration with NFSU and the National Forensic Data Grid, ensuring traceability and data integrity.

4. **Forensic Training and Capacity Building:**

Regular training programs should be conducted for food analysts, enforcement officers, and judicial

[14] M/S PepsiCo India Holdings Pvt. Ltd. & Anr. v. State of Punjab & Anr., 2024: PHHC 058302 (P&H H.C. Apr. 29, 2024),
[15] Sudan Dye Found in Indian Chilli Powder; Banned for Carcinogenic Risk," Down to Earth (Mar. 2, 2005)
[16] Centre for Pub. Interest Litig. v. Union of India, Writ Petition (C) No. 159 of 2012, (2013) 8 SCC 494 (India).
[17] Swami Achyutanand Tirth & Ors. v. Union of India & Ors., Writ Petition (Civil) No. 159 of 2012 (Supreme Court of India).

officers in forensic interpretation. NFSU can play a key role by designing short-term certification courses in Forensic Food Chemistry and Toxicology, enabling cross-disciplinary competence between law and science.

5. **Enhanced Evidentiary Recognition:**

The Bharatiya Sakshya Adhiniyam, 2023 should explicitly recognize forensic food reports as scientific expert evidence under Section 39 (Expert Opinion). This would strengthen the evidentiary value of forensic findings in both criminal prosecution and consumer redressal forums.

6. **Inter-Agency Coordination:**

A formal coordination mechanism should be developed between FSSAI, Consumer Commissions, and Forensic Laboratories to ensure timely transmission of test reports, minimize sample degradation, and maintain the chain of custody (CoC), as required under Section 106 of the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS).

7. **Periodic Surveillance and Public Disclosure:**

Mandatory quarterly publication of surveillance data, including categories of adulterants detected and laboratory outcomes, would enhance public awareness and corporate accountability. Public access to such information could also serve as a deterrent to potential offenders.

8. **Integration of Forensic Consumer Remedies:**

Consumers should be empowered to directly seek forensic verification of suspected adulterated products through FSSAI-authorized labs. This initiative could be linked to the Consumer Protection (E-Filing and Mediation) Rules, 2020, thereby facilitating faster redressal with scientific backing.

9. **Legislative Amendment for Stringent Penalties:**

Given the grave public health risks, repeat offences involving toxic adulterants like lead chromate, Sudan dyes, or synthetic chemicals should be classified as heinous economic offences, punishable with imprisonment of up to life, as recommended by the Supreme Court in the Milk Adulteration PIL (2011).

CONCLUSION

Food adulteration poses a continuing threat to consumer safety in India despite comprehensive laws under the Food Safety and Standards Act, 2006 and the Consumer Protection Act, 2019. The integration of forensic science into food safety enforcement marks a transformative step toward evidence-based regulation. Advanced forensic chemistry and toxicology enable precise detection of adulterants, scientific validation of contamination, and legally admissible proof under the Bharatiya Sakshya Adhiniyam, 2023. The 2025 FSSAI–NFSU notification represents a milestone by institutionalizing forensic laboratories within the national food testing framework, ensuring uniform standards, and strengthening enforcement capacity. Aligning with international benchmarks like the Codex Alimentarius, India is moving toward a science-driven system of consumer protection. To sustain this progress, consistent forensic training, standardized protocols, and inter-agency coordination are essential. Ultimately, safeguarding consumers from harmful food adulteration is not only a matter of regulatory compliance but a constitutional and public health duty, where law and science must work together to uphold the right to safe and wholesome food.