
SAFEGUARDING THE RIGHT TO FOOD: REGULATORY RESPONSES TO FOOD ADULTERATION IN THE AGE OF TECHNOLOGY

Komal Agarwal¹, Maglin M Raja² & Dr Swagatika Panigrahi³

ABSTRACT

Food adulteration has emerged as one of the most alarming public health and consumer protection challenges in the modern era. *Tainted Bites: Uncovering Food Adulteration Scandal* critically examines the growing menace of deliberate contamination, substitution, and misrepresentation of food products for economic gain. The study explores common forms of adulteration, such as the mixing of inferior substances, chemical preservatives beyond permissible limits, artificial colouring agents, and synthetic sweeteners that pose serious health risks.

The paper analyses the socio-economic drivers behind food adulteration, including profit maximisation, weak regulatory enforcement, lack of consumer awareness, and supply chain complexities. It further evaluates the legal framework governing food safety, particularly the role of the **Food Safety and Standards Act** and the regulatory functions of the **Food Safety and Standards Authority of India** in preventing and penalising such offences. Judicial responses and enforcement challenges are also examined to assess the effectiveness of existing mechanisms.

Through doctrinal analysis and case illustrations, the study highlights the urgent need for stricter monitoring systems, technological interventions in food testing, stronger punitive measures, and enhanced public awareness campaigns. It concludes that combating food adulteration requires a coordinated approach involving government authorities, industry stakeholders, and informed consumers to ensure food integrity, public health protection, and sustainable development.

Keywords: Food Adulteration, Food Safety, Public Health, Regulatory Framework, Technology for Identification of Adulterated Food, Right to Food.

¹Assistant Professor, B.A.L.L.B(Hons), L.L.M, Dr. Ambedkar Global Law Institute, Tirupati

²B.A.L.L.B, L.L.M, Research Scholar, Bhagwant University, Ajmer, Rajasthan, (Department of Law)

³B.A (Hons), L.L.B, L.L.M, PhD, Assistant Professor, Dr. Ambedkar Global Law Institute, Tirupati

INTRODUCTION:

The WHO states that health is not just the absence of disease or disability but a condition of complete physical, mental, and social well-being (WHO report 1978). Health is a big element of being human. Existence is always on the point of falling apart if you don't have good health and live a healthy existence. "Adulteration" is a legal term that means that a food product doesn't meet federal or state standards. Adding something that isn't food to food to improve it in its raw or cooked form is called adulteration. This type of modification might make the meal lose its real quality. Water and dead animals are two things that are used to make meat products worse.

Most food spoilage occurs during handling, as it travels from its originators to its end users. Hence, everyone needs to know about the basics of screening exams. When people degrade the quality of food for financial benefit or unrelated reasons, they are engaging in food adulteration. Such actions can be done by replacing ingredients, introducing unauthenticated chemicals, or deleting important components.⁴ Food fraud ultimately harms consumers' health and misleads them. Finding an unadulterated food market sector is a real challenge these days. This is why it's so important for shoppers to be aware of the most prevalent adulterants and how they could compromise their health. The proliferation of food manufacturers allows them to mislead and deceive consumers because of the large quantities of food they import. It is imperative that we avoid consuming chemicals commonly referred to as adulterants.⁵

Adulterant use in recent years. The nation's food safety requirements and the definition of adulterated food were set forth in the Prevention of Food Adulteration Act of 1954. If any of the following are true about a food item, it is considered adulterated:

1. Quality & Substitution

- **Misrepresentation:** The item is not what was requested or what it claims to be.
- **Inferior Substitutes:** Parts of the article have been replaced with cheaper or lower-quality materials.

⁴Gahukar RT. "Food adulteration & contamination in India" IJBAS 2014; 3(1):47-54.

⁵ Neetu S., Anita G "HAZARDS OF NEW TECHNOLOGIES IN PROMOTING FOOD ADULTERATEON." J E.N.V.S.C.I., T.O.X. F.S.C.I. 2013; 5 (1): 08 - 10.

- **Diluted Quality:** Contains substances that lower the overall quality or have been processed in a way that damages its nature.

2. Hygiene & Contamination

- **Unsanitary Handling:** Prepared, packed, or stored in unhygienic conditions leading to health hazards.
- **Decomposition:** Contains putrid, rotten, diseased, or "disgusting" substances (animal or vegetable).
- **Infestation:** Presence of insects or otherwise unfit for human consumption.
- **Unhealthy Origin:** Derived from an animal that was not healthy.

3. Chemical & Safety Hazards

- **Harmful Additives:** Contains poisonous ingredients or prohibited colourings/preservatives.
- **Excessive Limits:** Contains permitted additives but in amounts exceeding legal safety limits.
- **Toxic Packaging:** The container itself is made of harmful or poisonous materials.

Various Kinds of Food Adulteration

There are a couple of main types of food adulteration, though there are many more. There are two types of knowing: intentional and unintentional.⁶

Deliberate Adulteration

- Refers to the intentional modification of food products for economic gain.
- Involves the addition of inferior or substitute substances that closely imitate the texture,

⁶M.M. El-Loly, A.I.A. mansour and r.o. ramadan, evaluation of raw milk for common commercial additives and heat treatments, 15 INTERNATIONAL JOURNAL OF FOOD SAFETY 7 (2013).

taste or appearance of genuine foods, making detection difficult.

- Adulterants may be physical, chemical, or biological in nature.
- Common practices include:
 - Increasing volume by adding starch, wheat, cane sugar, vegetable oils, or water.
 - Enhancing profit margins through hazardous chemicals such as urea or melamine.
- Represents a serious ethical violation and public health concern.
- Prioritises financial benefit over consumer safety and human dignity.
- Results in reduced nutritional value of food products.
- Poses significant risks to human health due to the inclusion of toxic substances.⁷.

Unintentional/incidental adulteration

Food and drinks get adulterated when they are not kept clean and safe from the time they are made until they are eaten. Foodborne parasites, chemical residues, and rodent droppings are all examples of unintentional adulterants. It is also possible to accidentally get lead, mercury, and arsenic into metal. Rats and bugs are also inadvertent adulterants⁸.

Common Food Contaminants & Causes

- **Ubiquity of Contamination:** Most major food groups—including cereals, fruits, vegetables, and milk—frequently contain some level of impurities.
- **Source of Issue:** Contamination often occurs during the initial processing stages on farms, particularly when equipment or transit areas (like staircases and loading zones) are not adequately cleaned.

⁷Ibid

⁸S.K. Sahu ,G. Pandit, FOOD ADDITIVES AND CONTAMINANTS 153 (2002)- “PERSISTENT ORGANOCHLORINE PESTICIDE RESIDUES IN MILK AND DAIRY PRODUCTS IN INDIA”,

- **Physical Adulterants:** Common impurities found include:
 - Dust and sand
 - Gravel and small stones
 - Plant debris (leaves and stems)
- **Risk Level:** While these are considered "bad" impurities, they are generally classified as lower risk because they are visible and can be manually removed or cleaned by the consumer before consumption.

Adulteration of dairy products

Rapid **industrialisation, population growth**, and expanding **urbanisation** have collectively contributed to a significant increase in consumer demand, particularly for essential food commodities such as milk. Local dairy producers have often struggled to meet this escalating demand, creating opportunities for adulteration. Milk adulteration commonly involves dilution with water and the removal of natural fat content, thereby reducing its nutritional value. In addition, milk is frequently adulterated with substances such as soy, peanut, wheat flour, or starch to artificially enhance thickness and volume. Similarly, cow ghee and butter are often blended or substituted to maximise profit margins. Such practices not only **undermine the quality and integrity of the product** but also **pose serious risks to consumer health and safety**.

Adulteration of Fats and Oils

Fats and oils are highly susceptible to adulteration because foreign substances blend into them easily. Common adulterants like paraffin wax, castor oil, and hydrocarbons get added to increase volume or lower costs. These are tough to detect since they match genuine fats and oils in look and feel. Overall, this harms product quality and risks consumer health.

Adulteration of Food grain

Food grain adulteration is the deliberate mixing of foreign materials with cereal grains and legumes to artificially increase weight and profit margins.

Common Adulteration Practices:

- **Physical Bulking:** Adding crushed stones or sand to enhance the bulk density of the product.
- **Synthetic Mimicry:** Blending plastic beads that resemble the color and size of cereals and pulses into the supply, making detection difficult.
- **Moisture Manipulation:** Spraying grains with water to increase their weight.

Impact:

These practices compromise overall food quality and pose serious risks to consumer health and safety.

Other Forms of Adulteration

Food adulteration is frequently executed through the intermixing of distinct plant- and animal-based commodities, a strategy driven primarily by cost reduction and profit maximisation. Prominent instances of this phenomenon include the contamination of red chilli powder with brick powder and the dilution of commercial tea through the inclusion of exhausted or reused leaves. Honey represents a particularly significant target for such fraudulent practices, frequently undergoing adulteration with low-cost sweeteners. These extenders encompass sugar syrups and molasses altered by enzymatic or acidic processes, as well as syrups derived from corn, sugarcane, sugar beet, and natural sources such as maple syrup. Recent observations indicate a marked escalation in the blending of pure honey with synthetic variants derived from C4 plant sugars. Additionally, large-scale adulteration originating from Far Eastern regions has been identified as a critical issue. Collectively, these developments illustrate the growing sophistication of food fraud mechanisms and underscore the imperative for intensified regulatory oversight.⁹

Impact of Food Adulteration

Food we consume every day is hazardous and dirty because of problems with adulteration that

⁹V. Pilizota and N.T. Nedic, *Advances in Honey Adulteration Detection*, Food Safety Magazine (2009), available at <http://www.foodsafetymagazine.com/magazinearchive1/augustseptember-2009/advances-in-honey-adulterationdetection/>.

make it hard to handle properly.¹⁰ In recent decades, food adulteration has emerged as a prominent issue, presenting substantial risks to public health. The consumption of such contaminated food products is directly linked to the onset of severe medical conditions, including cancer, ulcers, diarrhea, and asthma. Food adulteration is bad for farmers, producers, processors, manufacturers, consumers, and the government in general.

Impact on commercial enterprises

Businesses are hurt when customers lose faith in their products, when they have to recall products and destroy them, when they have to pay to file complaints, when their insurance rates go up, and when they have to pay to replace or clean equipment. A mistake by a supplier will be reported in the news, which will hurt the company's reputation.¹¹

Impact on producers or farmers

□ **Broad Economic Impact:** Adulteration negatively affects both large-scale businesses and primary producers of commodities such as dairy, honey, coffee, and wheat.

□ **Vulnerability in the Industrial Chain:** Farmers and producers often represent the weakest link in the supply chain, making them highly susceptible to industry-wide damage.

□ **Financial and Resource Losses:** During adulteration crises, producers face significant financial deficits and rising costs for essential inputs like animal feed.

□ **Livestock and Infrastructure Depletion:** Crises can lead to the loss of breeding stock, as seen in the China dairy scandal where many milk cows were sold or culled.

□ **Market Instability:** Adulteration creates severe barriers to trade, leaving producers unable to sell their legitimate goods effectively.¹²

Issues faced by the consumers

Researchers have linked food contamination to adverse effects such as cancer, headaches,

¹⁰ Ibid

¹¹ S.D. Pandpal, A.K. Srivastava and K.S. Negi, *Estimation of quality of raw milk (opened and branded) by milk adulteration testing kit*, 24 Indian Journal of Community Health 188 (2012).

¹² Wu J., *China's dairy crisis- impacts, causes and policy implications for a sustainable dairy industry*. International journal of sustainable development and world ecology. 2011; 18 (5): 434-441.

visual issues, nausea, vomiting, diarrhoea, insomnia, and anaemia. For example, in 1988, 600 people in Kolkata, West Bengal, became paralysed after eating rapeseed oil that had been contaminated with tricresyl phosphate, a chemical that is common in varnishes and hydraulic fluids.¹³.

Public Health Impact

The medical evidence linking adulteration to public health crises is robust and alarming.

- **Acute Health Risks:**

- **Food Poisoning:** Immediate gastrointestinal epidemics (e.g., Salmonella, E. Coli) are commonly associated with street food and poor hygiene.
- **Toxicity:** Drinking methanol in fake spirits or chemical additives in oil (such as Argemone oil) can cause dropsy, blindness, or death.

- **Chronic Health Risks:**

- **Carcinogens:** Prolonged exposure to heavy metals (lead, arsenic) in vegetables and pesticide residues in cereals is closely correlated with increasing cancer rates in regions such as Punjab and Bihar.
- **Organ Damage:** Synthetic milk (urea, detergent) damages the kidneys and liver in ways that can't be fixed.
- **Nutritional Deficiencies:** Adulterating essentials like milk and legumes lowers their nutritional content, which makes hunger and stunting in children worse.

Different food items and their adulterants

¹³ Consumers unity & trust society (CUTS vrs State of West Bengal)

Food & drink items	Adulterant/extraneous substances	Purpose	Type of adulteration
Ghee	Vanaspati, anatta, & oleomargarine	To make more yellow	Deliberate
Milk	Water, skim milk	To increase volume	Deliberate
Condensed milk	Paneer, khoya	To give rich textur	Deliberate
Butter	Vegetable oil, anatta, banana, oleomargarine	To increase volume & make yellowish	Deliberate
Ice cream	Starch, rice powder or wheat flour	To thicken cream	Deliberate
Tea leaves	Black/Bengal gram dal husk with color	To add color	Deliberate
Red wine	Juice of bilberries	To attract/produce deep blue precipitate with lead acetate	Deliberate
Mustard oil	Papaya seed	To add bulk and weight	Deliberate
Black pepper	Papaya seed	To add bulk	Deliberate
Green chillies& peas	Malachite green	To give bright glowing green color	Deliberate
Chillies powder	Brick powder	To increase weight	Deliberate
Sugar	Chalk powder	To increase amount	Deliberate
Oils	Rancid oil	To increase volume	Deliberate
Coriander powder	Cow dung powder	To increase amount	Deliberate
Pulses	<i>Lathyrus sativus</i>	To increase weight	Deliberate
Common salt	White powdered stone, chalk	To increase amount	Deliberate
Coffee	Chicory, roasted barley powder, tamarind seeds	To add bulk and color	Deliberate
Honey	Molasses, cane sugar	To increase volume	Deliberate
Wheat	Ergot (poisonous fungus)	To increase weight	Deliberate
Jaggery powder	Chalk powder	To increase amount	Deliberate
Others like preservatives, etc.	Formalin, etc.	To increases shelf life	Unintentional

Food Adulteration: Recent Scandals & Trends

Recent investigations have exposed systemic adulteration in India's food supply chain, moving beyond simple dilution to complex chemical contamination.

- **The Tirupati Laddu Ghee Scandal (2024-2025):**

- **Incident:** When the Special Investigation Team (SIT) and FSSAI probes found that the ghee used in the holy Tirupati Laddus was mixed with palm oil and cow tallow/lard, there was a huge uproar.
- **Legal Implication:** This example showed that "Agmark" grading and internal quality checks don't work. It caused the Supreme Court to take notice on its own and led to calls for stronger testing rules for religious offerings (Prasadam).

- **The "Analogue" Dairy Crisis (2024):**

- **Incident:** FSSAI found that almost one in four samples of paneer and milk

sweets were "analogues," which means they were manufactured using vegetable fats and starches instead of milk fat without sufficient declaration. This was especially true in NCR and Rajasthan.

- **Key Finding:** These were sold as fresh dairy because of gaps in the law, which broke Section 3(1)(zf) of the FSS Act, 2006 (misbranding).

- **Spice Contamination (Ethylene Oxide):**

- **Incident:** Ethylene oxide, a pesticide residue that might cause cancer, was found in Indian spice brands (big participants in the market), which led to restrictions in Singapore and Hong Kong. Food safety commissioners in each state took action against this.

Recent High-Profile Incidents (Under Investigation/Trial)

These cases are currently shaping public discourse and may lead to significant future precedents.

- The "Dead Rat" Case at Barbeque Nation (Mumbai, 2024): A lawyer was sent to the hospital after allegedly finding a dead rat in a vegetarian dinner purchased using an app. The police filed a First Information Report (FIR) against the manager of the restaurant and the regional chef. This case is important since it includes both criminal negligence allegations and claims for consumer compensation.
- Bihar and Andhra Pradesh School Meals (2026): More than 140 pupils had to go to the hospital because they got sick from their noon meals. Parents can file a "class action" lawsuit against the NGOs or suppliers that provide the meals, even though the matter is mostly an administrative problem.

List of previously decided cases:

Case Name & Year	Brand / Establishment	Incident / Adulteration	Judgment & Compensation
McDonald's India v. Sh. Sandeep Saxena (2019) <i>(State Commission, Delhi)</i>	McDonald's	Insect/Mosquito in Burger: The complainant found an insect in his burger and suffered immediate vomiting and mental agony.	₹70,000 Total • ₹50,000 for mental agony • ₹20,000 litigation costs • Refund of medical expenses (approx..₹895).
Sanjot Singh Sidhu v. KFC (2019) <i>(District Forum, Chandigarh)</i>	KFC	Worm/Hair in Rice Bowl: The customer found a long hair with chicken pieces attached (indicating contamination) in a "Rice Bowl."	₹40,000 Total • ₹30,000 for harassment & mental agony • ₹10,000 litigation costs.
Aradhna Soft Drinks v. Sameer Bhardwaj (2010) <i>(NCDRC)</i>	Pepsi Co. (Bottler)	Housefly in Sealed Bottle: A dead housefly was visible inside a sealed bottle of "Slice" mango drink.	₹50,000 The NCDRC upheld the enhanced compensation, stating that a lab test wasn't needed when the foreign object was visible to the naked eye.
PepsiCo India Holdings v. Ramlal Gupta (Settled 2025) *	Pepsi	Glass Shard in Drink: A consumer found a glass piece in a soft drink bottle purchased in Bhadohi.	₹1.5 Lakh Ordered by the District Commission; paid as a settlement for mental anguish and social harm.

Case Name & Year	Brand / Establishment	Incident / Adulteration	Judgment & Compensation
Domino's Pizza v. Mrs. Poonam Chaudhary (2017) (NCDRC)	Domino's Pizza	Veg/Non-Veg Mix-up: A vegetarian family was delivered a non-veg pizza in a box marked with a "Green Dot" (Vegetarian).	₹7,000 Held as a “deficiency in service” violating religious sentiments and dietary restrictions.
Kishan Hegde Kolkebail v. KFC (2016) (District Forum, Udupi)	KFC	Stale/Rotten Chicken: The customer was served rotten chicken strips, leading to food poisoning/illness.	₹15,242 Includes medical expenses refund and compensation for "rough behaviour" by the manager.
Santosh Mathew v. Susheela Bakery (2024) (District Commission, Ernakulam)	Local Bakery	Food Poisoning: The entire family was hospitalized after eating old/stale "puffs."	₹50,000 For serving unsafe food and causing health hazards to a family.

Legal framework:

FSS Act, 2006:

The legal backbone of food safety in India is governed by the FSS Act, 2006, and its subsequent regulations.

- **Key Regulations:**

- **FSS (Licensing and Registration of Food Businesses) Regulations, 2011:**
Mandates that every Food Business Operator (FBO) must obtain a licence.
- **FSS (Food Products Standards and Food Additives) Regulations, 2011:**
Defines the vertical standards for specific food products (e.g., what chemical

composition constitutes "milk" or "honey").

- **FSS (Contaminants, Toxins, and Residues) Regulations, 2011:** Sets the "Maximum Residue Limits" (MRLs) for pesticides, heavy metals, and crop contaminants.
- **Adjudication Process:**
 - The framework shifts from a purely criminal approach to a civil penalty mechanism for minor offences (like misbranding), adjudicated by an Additional District Magistrate (ADM).

Serious offences (unsafe food causing injury/death) are tried in special courts.

FSSAI: The Regulatory Body

The Food Safety and Standards Authority of India (FSSAI) is the supreme statutory body responsible for supervision and regulation of food safety.

- **Mandate:** Established under the **Food Safety and Standards Act, 2006 (FSS Act)**, it consolidates various older laws (like the PFA Act, 1954) into a single point of command.
- **Recent Enforcement Actions:**
 - **Surveillance:** FSSAI has ramped up the "Food Safety on Wheels" initiative—mobile labs for spot testing.
 - **Labelling Rules:** Introduction of stricter labeling norms for "HFSS" (High Fat, Sugar, Salt) foods and front-of-pack labeling (FOPL) proposals to combat non-communicable diseases.
 - **Eat Right India:** A flagship movement to certify campuses, stations, and temples as "Eat Right" zones to ensure hygiene standards.

Legal Provisions & Penalties

Legal recourse against adulteration is primarily found in the FSS Act, 2006, backed by the

Indian Penal Code (IPC).

A. Food Safety and Standards Act, 2006 (FSSA)

Statute	Section	Nature of Offense	Penalty / Punishment
FSSA, 2006	Sec 50	Selling food not of the nature/substance/quality demanded	Penalty up to ₹5 Lakhs
FSSA, 2006	Sec 51	Sub-standard food (not meeting quality standards)	Penalty up to ₹5 Lakhs
FSSA, 2006	Sec 52	Misbranded food (false claims/labels)	Penalty up to ₹3 Lakhs
FSSA, 2006	Sec 59	Unsafe food (Injurious to health)	6 months to Life Imprisonment + Fine up to ₹10 Lakhs
FSSA, 2006	Sec 27	Liability of Manufacturers/Distributors	Extends accountability to the entire supply chain
BNS, 2023	Sec 274	Adulteration of food or drink (to make it noxious/harmful)	Imprisonment up to 6 months or a fine up to ₹5,000, or both
BNS, 2023	Sec 275	Sale of noxious food or drink (knowingly selling harmful items)	Imprisonment up to 6 months or Fine up to ₹5,000, or both

Note: In some states (e.g., UP, West Bengal), state amendments have made these offences punishable by life imprisonment, though the FSS Act is often the preferred legislation due to its specificity.

Consumer Protection Act, 2019

- Introduces the concept of **product liability**. A consumer can sue a manufacturer or seller for compensation if defective/adulterated food causes harm.

Right to Food by Judicial Interpretation

In light of the issues outlined, it can be argued that India's contemporary food culture has reached a critical nadir, characterised by the pervasive risk of counterfeit products in the marketplace. This systemic adulteration extends even to life-saving pharmaceuticals, compromising their purity and efficacy. Such practices constitute a direct infringement of the Art 21, which is recognised both as a fundamental right under the Indian Constitution and as an inherent human birthright. Consequently, those responsible for such violations should be subject to rigorous legal penalties. Given that the Indian legal framework lacks an explicit statutory mechanism for invoking violations of the right to food, the primary responsibility for addressing these systemic failures and enforcing accountability rests with the judiciary. The judiciary has incorporated the right to food as an integral component of the right to life under Article 21 through numerous case laws.

The enforcement of the "*right to food*" by courts offers several strategic advantages within Indian legal framework. As the Constitution designates the courts as the primary protectors of fundamental rights, judges are empowered to define and interpret these entitlements with a level of authority that is binding upon all governmental and non-governmental entities. Furthermore, judicial enforcement allows for the integration of international human rights principles into the interpretation of state laws, providing citizens with more robust legal remedies when their rights are violated. Ultimately, judicial intervention serves as a critical mechanism for ensuring accountability, as court mandates create a binding obligation for the government to take proactive measures in addressing food security and safety.

The government usually sees giving people the right to food as a nice thing to do, not as a way to make up for the rights of the people. Fourth, if a law is unclear on a subject, the courts are the best place to clear things up. Fifth, the political system is not stable. So, the political system can't make sure that people have enough food.

In the case of *Fransis Coralie v. Union Territory of Delhi*, the Supreme Court of India established a significant judicial precedent by expanding the interpretation of **Article 21**. The Court ruled that the "**right to life**" transcends mere "**animal existence**", asserting that it fundamentally encompasses the right to live with "**human dignity**". Under this expanded doctrine, the right to life necessitates access to the **basic necessities of life** & the protection of

the **bare minimum activities and functions** essential to the expression of the human self.¹⁴

Bandhua Mukti Morcha v. Union of India provides another wide declaration of the right to live with dignity.¹⁵ The court said, "To live with human dignity and without being exploited, it includes protecting the health and strength of workers, both men and women, as well as the tender age of children against abuse; giving children the chance to grow up in a healthy way and in conditions of freedom and dignity; providing educational opportunities; providing fair and humane working conditions; and providing maternity leave." "To live with human dignity, these are the least things that need to be in place. No government can do anything to take away a person's right to enjoy these basic rights.

The Supreme Court in *Chameli Singh v. State of Uttar Pradesh*¹⁶ held that the right to food, water, and a clean environment is part of what it means to have a good and civilised life. The court has said this in this case: In any well-organised community, supplying simply the basic necessities of people does not guarantee their right to survive as human beings. It is only safe when he knows he has all the resources he needs to grow and is free from any limits that hold him back. The goal of all human rights is to do this. In *Kishen Pattnayak & Ors. Vrs. State of Orrisa*¹⁷, people said that many people are battling against starvation in Koraput, Kalahandi, etc. It was also said that no one in this country should have to go without or be taken advantage of, especially because our Constitution says that social justice is important.

Nevertheless, the ruling didn't say which article of the Constitution may be used if someone's basic right to not be hungry or starved was violated. So, this decision doesn't do enough to make sure that violations are punished. Later, in *PUCL v. UOI*¹⁸

¹⁴Sanjeev Gowda G.S., *right to food in india: a constitutional perspective*, 3 *Int'l Journal of Law & Legal Jurisprudence Studies* (ISSN 2348-8212) Issue 2, available at <http://ijllj.s.in/wp-content/uploads/2016/04/3.pdf> (last visited Feb. 10, 2026).

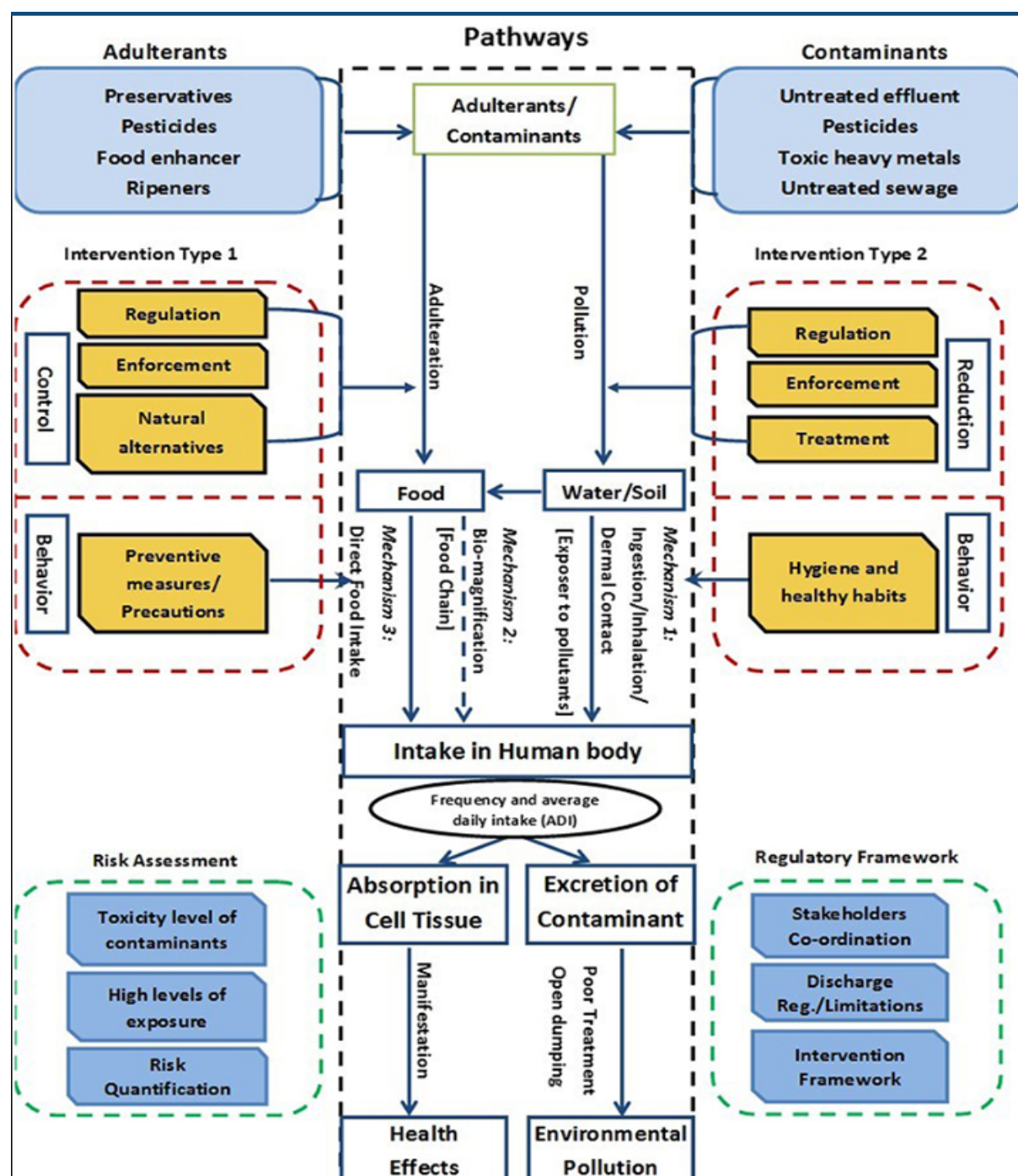
¹⁵ AIR 1984 SC 802

¹⁶ AIR 1996 SC 1051

¹⁷ AIR 1989 SC 677

¹⁸People's Union for Civil Liberties (PUCL) v. Union of India, Writ Petition (Civil) No. 196 of 2001 (Supreme Court of India).

THE VICIOUS CYCLE OF ADULTERATION



This diagram illustrates the pathways of contaminants and adulterants entering the human body, the mechanisms involved, and the frameworks for intervention to mitigate health effects and environmental pollution.

Contamination Pathways: There are many ways that pollutants can get into food and water, such as untreated sewage, toxic metals, and pesticides.

Mechanisms of Exposure: People can be exposed to something by eating it, touching it with their skin, or breathing it in, which causes it to be absorbed into their cells.

Intervention Framework: People can be exposed via eating food, touching their skin, or breathing in, which causes the chemicals to be absorbed by cell tissues.

Tech solution for Adulterated Food

Technologies for detecting food fraud have come a long way. They now use a variety of molecular, chemical, and sensor-based methods to make sure food is safe and real. Genomics-based methods like PCR, next-generation sequencing, DNA barcoding, and CRISPR-Cas systems can find even the smallest amounts of adulterants by targeting genetic material. This makes them useful for complicated cases of adulteration.¹⁹ Analytical techniques such as chromatography (HPLC, GC), spectroscopy (FTIR, Raman, NMR), and electrophoresis are extensively employed to identify chemical and compositional adulterants in diverse food categories, with chemometrics facilitating data interpretation.²⁰ Electroanalytical approaches using modified electrodes and electronic tongues provide cost-effective, sensitive options suitable for on-site testing and real-time monitoring²¹. Artificial intelligence combined with sensor technologies allows for quick and accurate classification and prediction of adulteration, which helps with large-scale quality assessment and stopping fraud.²² Emerging developments highlight non-destructive methodologies and paper-based microfluidic devices for cost-effective, expedited screening at the point of care, while continuous research aims to integrate AI, machine learning, and multi-modal sensing to enhance detection accuracy and regulatory adherence.

¹⁹Cao G. & Li Z ZhaoJ, Yang W., Cai H, current progress and future trends of genomics-based techniques for food adulteration identification, 14 *Foods* (2025), <https://doi.org/10.3390/foods14071116> (last visited Feb. 10, 2026).

²⁰Mortas M., Awad N. & Ayvaz H., *Adulteration Detection Technologies Used for Halal/Kosher Food Products: An Overview*, 2 *Discover Food* (2022), <https://doi.org/10.1007/s44187-022-00015-7> (last visited Feb. 10, 2026).

Elumalai A. & Natarajan V., *Advancements in Analytical Technologies for Ensuring Food Quality and Authentication: A Comprehensive Review*, *Journal of Food Composition and Analysis* (2025), <https://doi.org/10.1016/j.jfca.2024.107075> (last visited Feb. 10, 2026).

²¹Tsopelas F., Electroanalytical Approaches to Combatting Food Adulteration: Advances in Non-Enzymatic Techniques for Ensuring Quality and Authenticity, 30 *Molecules* (2025), <https://doi.org/10.3390/molecules30040876> (last visited Feb. 10, 2026).

²²othman s., mavani n., hussain m., rahman n. & ali j., *artificial intelligence-based techniques for adulteration and defect detections in food and agricultural industry: a review*, *journal of agriculture and food research* (2023), <https://doi.org/10.1016/j.jafr.2023.100590> (last visited feb. 10, 2026).