International Journal of Enhanced Research in Educational Development (IJERED)
ISSN: 2320-8708, Vol. 14 Issue 3, May-June, 2026

Irregular Labelling and Hidden Adulteration in Genetically Modified Food Products in India

Devesh Kumar[1], Dr. Mohd. Amir[2]

ABSTRACT

Genetically Modified (GM) food products have become an important part of modern agricultural and food production systems due to their potential to increase productivity, improve nutritional quality, and enhance resistance to pests and diseases. Despite these benefits, genetically modified foods continue to generate serious concerns relating to food safety, environmental protection, ethical considerations, and consumer rights. In India, the issues of irregular labelling and hidden adulteration in genetically modified food products have emerged as significant challenges within the food regulatory system. Irregular labelling refers to false, misleading, incomplete, or non-disclosure of genetically modified ingredients on food packaging, while hidden adulteration involves the unauthorized mixing, substitution, contamination, or concealment of genetically modified substances in conventional food products without consumer knowledge or regulatory approval. Such practices violate the consumer's right to information and undermine transparency, food safety, and public confidence in food markets. This article examines the concept, causes, and forms of irregular labelling and hidden adulteration in genetically modified food products in India. It further analyses the legal and regulatory framework governing genetically modified foods, including the Environment (Protection) Act, 1986, the Rules of 1989, the Food Safety and Standards Act, 2006, and the role of the Food Safety and Standards Authority of India (FSSAI). The article also discusses public health concerns, environmental implications, judicial developments, international regulatory approaches, and challenges faced in implementing effective monitoring systems. The study concludes that although genetically modified foods offer substantial agricultural and economic advantages, weak regulatory enforcement, inadequate testing infrastructure, lack of consumer awareness, and absence of strict mandatory labeling standards continue to facilitate irregular labelling and hidden adulteration in India. The article emphasizes the need for stronger legal mechanisms, mandatory disclosure systems, scientific monitoring, consumer awareness programs, and effective enforcement strategies to ensure transparency, food safety, and protection of consumer rights in the regulation of genetically modified food products.

Keywords: ***Genetic, Labelling, Adulteration, Environmental Protection, Public Health, Biosafety, Food***

INTRODUCTION

The emergence of biotechnology and genetic engineering has revolutionized agricultural production throughout the world. Scientific developments in modern agriculture have enabled researchers to alter the genetic composition of plants and organisms to improve productivity, nutritional quality, pest resistance, and environmental adaptability. Foods produced from such genetically engineered organisms are known as Genetically Modified (GM) foods.

Genetically Modified foods have become an important part of global food systems because they promise solutions to food scarcity, malnutrition, crop diseases, and agricultural inefficiency. However, despite these advantages, genetically modified food products continue to generate significant controversies relating to public health, environmental protection, consumer rights, ethical concerns, and food safety regulation.

One of the most serious issues associated with genetically modified food products in India is irregular labeling and hidden adulteration. Consumers rely on food labels to understand the ingredients, nutritional content, source, quality, and safety of food products. When labels are misleading, incomplete, or false, consumers are deprived of their right to make informed choices. Similarly, hidden adulteration occurs when genetically modified ingredients are mixed, substituted, or concealed in conventional food products without proper disclosure or regulatory approval.

[1] Research Scholar, School of Law and Constitutional Studies, Shobhit Institute of Engineering & Technology (Deemed to- be- University), Meerut (U.P.) – India- 250110
[2] Assistant Professor, School of Law and Constitutional Studies, Shobhit Institute of Engineering & Technology (Deemed to- be- University), Meerut (U.P.) – India- 250110

The problem has become increasingly important in India due to the growing import of processed foods, edible oils, soy products, and corn derivatives containing genetically modified ingredients. Reports and studies have suggested that several food products available in Indian markets allegedly contain genetically modified substances without proper labeling or certification. Such practices raise concerns regarding public health, biosafety, environmental sustainability, and consumer protection.

1.2 Meaning of Genetically Modified Food Products

Genetically Modified food products are foods obtained from organisms whose genetic material has been artificially altered using genetic engineering techniques. Scientists insert genes from one organism into another to obtain desirable characteristics.

Unlike traditional breeding methods, genetic engineering directly modifies DNA at the molecular level.

Objectives of Genetic Modification

The major objectives include:

1. Increasing agricultural productivity,
2. Improving nutritional quality,
3. Enhancing resistance to pests and diseases,
4. Improving shelf life of food products,
5. Reducing dependence on pesticides and herbicides,
6. Enhancing resistance to drought and climatic stress.

For example:

- Bt Cotton contains genes from the bacterium *Bacillus thuringiensis* that protect crops from insect pests.
- Golden Rice is genetically modified to contain Vitamin A.
- Herbicide-resistant soybean crops allow farmers to control weeds more efficiently.

In India, Bt Cotton has been approved for commercial cultivation, whereas genetically modified food crops such as Bt Brinjal remain controversial and subject to regulatory scrutiny.[3]

1.3 Meaning of Irregular Labelling

Food labelling refers to the disclosure of information regarding ingredients, nutritional value, manufacturing details, expiry dates, safety warnings, and origin of food products.

In the context of genetically modified foods, labelling is particularly important because consumers possess the right to know whether a product contains genetically modified ingredients.

Irregular labelling means false, incomplete, misleading, deceptive, or improper disclosure regarding genetically modified ingredients present in food products.

It may include:

- Failure to disclose genetically modified ingredients,
- False “GM-free” claims,
- Misleading advertisements,
- Incorrect ingredient declaration,
- Absence of mandatory warning labels,
- Misbranding of imported food products,
- Use of deceptive packaging designs.

For example, a food product may contain genetically modified soybean oil but fail to disclose this information on the package label. Similarly, products may falsely claim to be “organic” or “natural” despite containing genetically engineered substances.

Irregular labelling violates consumer rights and undermines transparency in food markets.[4]

1.4 Meaning of Hidden Adulteration

Hidden adulteration refers to the unauthorized mixing, substitution, contamination, or concealment of genetically modified substances in conventional food products without proper disclosure or approval.

Adulteration may occur intentionally for economic gain or unintentionally due to contamination during production and transportation.

[3] “FSSAI proposes labelling norm for food products with GM ingredients,” *Business Standard*, 8 May 2018. (business-standard.com)

[4] Food Safety and Standards (Packaging and Labelling) Regulations, 2011. (indiafilings.com)

Forms of Hidden Adulteration

1. Intentional Adulteration: Manufacturers may deliberately substitute conventional ingredients with cheaper genetically modified ingredients to reduce production costs.
For example: GM soybean oil may be mixed with ordinary edible oil without disclosure.
2. Cross-Contamination: Genetically modified crops may contaminate non-GM crops through: Cross-pollination, Transportation, Storage, Processing.
3. Import-Based Adulteration: Imported processed foods may contain genetically modified corn, soy, or canola derivatives without proper labelling.
4. Misbranding: Products may falsely claim to be: Organic, Natural, Non-GMO,despite containing genetically modified substances.

1.5 Causes of Irregular Labelling and Hidden Adulteration

Several factors contribute to the problem in India:
1. Weak Regulatory Enforcement: India does not yet possess a fully comprehensive and effectively coordinated legal framework exclusively governing genetically modified food labeling and adulteration. Although laws exist, enforcement mechanisms remain weak due to: lack of coordination, inadequate inspections and limited monitoring capacity.

2. Increasing Import of Processed Foods: India imports large quantities of: edible oils, soy products, corn derivatives and packaged foods. Many imported products may contain genetically modified ingredients without proper disclosure.
3. Inadequate Testing Infrastructure: Advanced DNA and PCR-based testing laboratories are limited in number. As a result: authorities face difficulty detecting GM substances, and contamination often remains unidentified.
4. Commercial Profit Motives: Manufacturers may conceal genetically modified ingredients because: GM substances are cheaper, consumers may avoid GM foods, and labelling requirements increase costs.
5. Lack of Consumer Awareness: Many consumers are unaware:

- what GM foods are,
- how to identify them,
- what labeling regulations exist.

7. **Globalization of Food Markets:** Global food trade increases movement of genetically modified products across borders, making regulation more difficult.

1.6 Legal Framework Governing GM Food Products in India

India regulates genetically modified foods through environmental laws, food safety legislation, and consumer protection laws.

1. Environment (Protection) Act, 1986: The Environment (Protection) Act, 1986 forms the legal foundation for regulation of genetically engineered organisms in India.

Rules of 1989

Under this Act, the government framed: "Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells, 1989."
These Rules regulate: research, manufacture, import, storage and sale of genetically engineered products. Authorities established include:
(a) Genetic Engineering Appraisal Committee (GEAC): The GEAC approves activities involving large-scale use and commercialization of genetically modified organisms.
(b) Review Committee on Genetic Manipulation (RCGM): This committee supervises safety aspects of ongoing research.
(c) Institutional Biosafety Committees (IBSC): These committees monitor biosafety measures within research institutions.

2. Food Safety and Standards Act, 2006: The Food Safety and Standards Act, 2006 regulates food safety in India.

- **Section 22:** prohibits, manufacture, sale, distribution and import of genetically modified foods without approval.[5]
- The Food Safety and Standards Authority of India (FSSAI) regulate: food labelling, packaging, safety standards and import control.

3. FSSAI Labelling Regulations: FSSAI proposed that food products containing genetically engineered ingredients beyond prescribed limits must carry labels such as: Contains GMO/Ingredients derived from GMO.[6] The regulations aim to ensure: transparency, consumer awareness and informed choice.

[5] Food Safety and Standards Act, 2006, s. 22.
[6] FSSAI Draft Food Safety and Standards (Genetically Modified Foods) Regulations, 2022. (fssai.gov.in)

4. Consumer Protection Act, 2019: False or misleading labelling may amount to unfair trade practice. Consumers possess rights: to information, to safety, to informed choice and against unfair trade practices.

1.7 Public Health Concerns

Irregular labelling and hidden adulteration create serious public health concerns:

1. Allergic Reactions: Consumers may unknowingly consume genetically modified ingredients despite allergies or dietary restrictions.

2. Long-Term Health Effects: Debates continue regarding possible long-term effects of genetically modified foods on: immunity, metabolism and antibiotic resistance.

3. Lack of Informed Consent: Consumers cannot make informed dietary choices when labelling is misleading.

1.8 Environmental Concerns

1. Loss of Biodiversity: GM crops may reduce traditional crop diversity.

2. Cross-Pollination: Genes from genetically modified crops may spread to non-GM crops.

3. Development of Resistant Pests: Pests may gradually develop resistance to genetically engineered crops.

1.9 Judicial Developments

The judiciary plays an important role in protecting public health, consumer rights, and environmental safety in matters relating to genetically modified (GM) food products. Indian courts have repeatedly emphasized the importance of transparency, scientific scrutiny, biosafety regulation, and mandatory labelling in the regulation of genetically modified foods. Judicial interventions have mainly focused on protecting consumers from hidden adulteration, ensuring proper regulatory oversight, and directing government authorities to establish comprehensive standards for genetically modified food products.

1. Role of Judiciary in GM Food Regulation

The Indian judiciary has recognized that genetically modified food products involve several constitutional and public interest concerns, including:

- Right to life and health under Article 21 of the Constitution,
- Consumer right to information,
- Environmental protection,
- Food safety,
- Public health,
- Sustainable development.

Courts have frequently applied the precautionary principle in cases involving genetically modified organisms (GMOs), emphasizing that scientific uncertainty should not justify unrestricted commercialization of genetically modified food products.

2. Rajasthan High Court Directions (2025)

One of the significant recent judicial developments occurred when the Rajasthan High Court directed the Central Government and the Food Safety and Standards Authority of India (FSSAI) to formulate comprehensive safety standards and regulatory mechanisms for genetically modified food products.[7]

The Court observed that:

- Several imported food products allegedly containing genetically modified ingredients were entering Indian markets without adequate testing and certification;
- Existing regulatory mechanisms were insufficient to ensure transparency and consumer protection;
- Consumers possess the right to know whether food products contain genetically modified ingredients.

The Court directed authorities to:

1. Establish comprehensive safety standards for genetically modified foods;
2. Ensure scientific scrutiny and testing of imported food products;
3. Introduce mandatory certification systems;
4. Require proper "GM-free" labelling for imported products;
5. Strengthen customs monitoring and inspection mechanisms.

The judgment highlighted the importance of balancing technological advancement with consumer safety and public health protection. The Court also emphasized that lack of proper labelling and testing may expose consumers to unknown health risks and violate principles of informed consent and transparency.[8]

3. Precautionary Principle and Environmental Jurisprudence

Indian courts have often relied upon the precautionary principle while dealing with environmental and biotechnology-related issues. The precautionary principle means that where scientific uncertainty exists regarding possible

---

[7] Rajasthan High Court directions regarding GM food safety standards (2025). (timesofindia.indiatimes.com)

[8] Food Safety and Standards Act, 2006, s. 22.

environmental or health risks, authorities must adopt preventive measures rather than waiting for complete scientific certainty. This principle has become part of Indian environmental jurisprudence through judicial decisions of the Supreme Court.[9] In matters relating to genetically modified crops and foods, courts have emphasized that:

- public health and environmental protection should receive priority,
- scientific safety assessments must be conducted before commercialization,
- regulatory authorities must exercise caution while approving genetically modified products.

4. Public Interest Litigations (PILs) Relating to GM Crops and Foods

Several Public Interest Litigations have been filed before Indian courts challenging:

- Field trials of genetically modified crops,
- Commercialization of Bt Brinjal,
- Lack of biosafety assessments,
- Absence of proper labeling standards,
- Weak regulatory mechanisms.

These petitions argued that:

- genetically modified food products may affect biodiversity,
- inadequate labeling violates consumer rights,
- lack of scientific transparency threatens public health.

The judiciary has repeatedly directed the government to adopt scientific and transparent regulatory systems before approving genetically modified products for public consumption.

5. Supreme Court's Approach Towards Biosafety and Food Regulation

Although the Supreme Court has not completely prohibited genetically modified food products, it has consistently emphasized:

1. Scientific risk assessment,
2. Transparency in regulatory decision-making,
3. Protection of biodiversity,
4. Consumer awareness,
5. Strict biosafety measures.

The Court has stressed that regulatory authorities such as:

- Genetic Engineering Appraisal Committee (GEAC),
- Food Safety and Standards Authority of India (FSSAI),

The Court also highlighted that environmental and health risks associated with genetically modified products require careful monitoring and periodic review.[10]

6. Consumer Rights and Right to Information

Judicial developments have increasingly recognized that consumers possess a fundamental right to know the contents and composition of food products. Improper or misleading labelling of genetically modified foods may violate: Right to information, Consumer protection laws, Principles of informed consent, and Fair-trade practices.

Courts have observed that:

- consumers should be able to make independent dietary choices,
- proper labelling is essential for transparency and accountability.

This approach strengthens the role of labelling laws in preventing hidden adulteration and deceptive food practices.

1.10 Challenges in Regulation

These challenges affect consumer protection, public health, environmental safety, and transparency in food systems:

1. Lack of Comprehensive and Exclusive Legislation: One of the major challenges in India is the absence of a single comprehensive law exclusively governing genetically modified food products and labelling requirements.[11] At present, regulation is scattered across different laws such as:

- Environment (Protection) Act, 1986,
- Food Safety and Standards Act, 2006,
- Consumer Protection Act, 2019,
- Legal Metrology Act, 2009.

[9] Vellore Citizens Welfare Forum v. Union of India — Recognition of the precautionary principle as part of Indian environmental law.

[10] Public Interest Litigations concerning genetically modified crops and biosafety regulation before the Supreme Court of India.

[11] Food Safety and Standards Act, 2006, s. 22.

2. Weak Enforcement Mechanisms: Another major challenge is weak enforcement of existing regulations. Regulatory authorities such as the Food Safety and Standards Authority of India (FSSAI), the Genetic Engineering Appraisal Committee (GEAC), customs authorities, and state food safety departments often face shortage of trained personnel, inadequate inspections, limited monitoring mechanisms, and lack of coordination. Due to weak enforcement systems, mislabeled or adulterated genetically modified food products may enter the market without proper scrutiny or testing. Regulatory agencies frequently face practical difficulties in ensuring compliance with safety standards and labeling requirements.

3. Inadequate Testing Infrastructure: Inadequate scientific infrastructure and testing facilities also create serious obstacles in regulating genetically modified foods. Detection of genetically modified ingredients requires advanced scientific techniques such as Polymerase Chain Reaction (PCR) testing, DNA sequencing, and molecular analysis. However, India has limited numbers of advanced laboratories equipped to conduct accurate and large-scale testing of genetically modified substances. Lack of technological resources, shortage of trained experts, and high testing costs make monitoring and surveillance difficult. As a result, hidden adulteration and contamination often remain undetected.[12]

4. Lack of Consumer Awareness: Another important challenge is lack of consumer awareness regarding genetically modified foods and labeling systems. Many consumers do not understand what genetically modified foods are, how to identify them, or what labeling regulations exist. Due to this lack of awareness, consumers are unable to demand transparency or challenge misleading labeling practices effectively. Manufacturers may therefore continue using false "GM-free," "natural," or "organic" claims without significant public resistance.

5. Cross-Contamination and Environmental Risks: Cross-contamination between genetically modified and non-genetically modified crops presents another regulatory challenge. Genetically modified crops may contaminate conventional crops during cultivation, transportation, storage, or processing. Such contamination makes it difficult to maintain purity standards or certify products as "GM-free." Cross-pollination and environmental spread of genetically modified traits may also affect biodiversity and ecological balance.

6. Scientific Uncertainty and Health Concerns: Scientific uncertainty regarding the long-term health and environmental impact of genetically modified foods further complicates regulation. Debates continue regarding allergenicity, antibiotic resistance, environmental effects, and long-term health consequences of genetically modified food consumption. Because scientific certainty is not absolute, regulators and courts often rely upon the precautionary principle, which requires preventive measures where potential risks to public health or the environment exist despite scientific uncertainty.[13]

7. Poor Coordination Among Regulatory Authorities: Poor coordination among regulatory agencies also weakens effective governance. Several authorities, including FSSAI, GEAC, customs authorities, agricultural departments, and environmental agencies, regulate different aspects of genetically modified foods. Lack of coordination among these institutions leads to duplication of responsibilities, policy inconsistencies, delays in decision-making, and ineffective monitoring systems.

1.11 Suggestions and Reforms

1. Enactment of Comprehensive Legislation: India should enact a separate and comprehensive law exclusively dealing with genetically modified food products, labelling requirements, biosafety standards, and hidden adulteration. A specialized legislation would remove ambiguity, ensure uniform regulation, and clearly define the powers and responsibilities of regulatory authorities. Such a law should include provisions relating to mandatory disclosure, traceability, import control, liability for contamination, and penalties for violations.[14]

2. Mandatory and Clear GM Food Labelling: All food products containing genetically modified ingredients should carry mandatory and visible labels stating: Contains Genetically Modified Ingredients" or "Contains GMO. The labelling should be: clear, easily readable, scientifically accurate, displayed prominently on packaging. Mandatory labeling would protect the consumer's right to information and enable individuals to make informed dietary choices based on health, ethical, environmental, or religious considerations.[15]

---

[12] Gurinder Jit Randhawa et al., "Monitoring Unauthorized Genetically Modified Events in India," *Journal of Agricultural and Food Chemistry* (2014). (pubs.acs.org)

[13] Vellore Citizens Welfare Forum v. Union of India — Recognition of the precautionary principle in Indian environmental law.

[14] Ministry of Environment, Forest and Climate Change (MoEFCC), Guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, Government of India.

[15] Parliamentary Standing Committee on Agriculture, Report on Cultivation of Genetically Modified Food Crops — Prospects and Effects.

3. Strengthening Testing Infrastructure: India should establish advanced scientific laboratories equipped with modern technologies such as: PCR testing, DNA sequencing, and molecular analysis.
Testing laboratories should be available at:

- ports,
- customs checkpoints,
- food safety departments,
- research institutions.

Strengthening testing infrastructure would improve detection of hidden adulteration and unauthorized genetically modified ingredients.[16]

4. Strict Monitoring of Imported Food Products: Imported processed foods, edible oils, soybean products, and corn derivatives should undergo compulsory testing and certification before entering Indian markets. Customs authorities and food safety agencies should coordinate closely to ensure proper inspection and screening of imported products. Imported food items should not be allowed for sale unless they comply with Indian biosafety and labelling standards.

5. Application of the Precautionary Principle: Regulatory authorities should strictly apply the precautionary principle while approving genetically modified food products. Where scientific uncertainty exists regarding possible risks to public health or the environment, preventive measures should be adopted until adequate safety data becomes available. Indian courts have recognized the precautionary principle as part of environmental jurisprudence.[17]

6. Promotion of Scientific Research and Transparency: Scientific research regarding the long-term health and environmental impact of genetically modified foods should be encouraged. Regulatory authorities should ensure transparency in approval procedures, safety assessments, and scientific studies relating to genetically modified products. Public access to scientific information would improve consumer confidence and democratic participation in food regulation.

7. Adoption of International Standards: India should harmonize its biosafety and labeling standards with international guidelines such as:

- Cartagena Protocol on Biosafety,
- Codex Alimentarius standards,
- World Health Organization (WHO) guidelines.

Adopting international best practices would improve food safety regulation and strengthen India's ability to regulate imported genetically modified food products effectively.[18]

8. **Encouraging Ethical and Responsible Biotechnology:** Biotechnology companies and food manufacturers should follow ethical business practices and prioritize consumer safety over commercial profits. Responsible corporate conduct and self-regulation can significantly reduce misleading labelling and hidden adulteration practices.

CONCLUSION

Irregular labelling and hidden adulteration in genetically modified food products represent serious threats to food safety, consumer rights, public health, and environmental sustainability in India. Although genetically modified foods may contribute significantly to agricultural development and food security, lack of transparency and weak enforcement mechanisms undermine public confidence. India requires stronger laws, mandatory disclosure systems, advanced scientific monitoring, effective regulatory institutions, and public awareness programs to regulate genetically modified food products efficiently. Transparent labelling, informed consumer choice, and strict regulatory oversight are essential for maintaining food safety and protecting public health.

[16] Greenpeace India Reports on Biosafety and Genetically Modified Food Regulation in India.
[17] Vellore Citizens Welfare Forum v. Union of India — Recognition of the precautionary principle in Indian environmental law.
[18] Cartagena Protocol on Biosafety, 2000; Codex Alimentarius Commission Guidelines on Foods Derived from Biotechnology.