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CUET · HOME SCIENCE · CLASS XII · CODE 315

Food Quality and Food Safety

CUET unit: Unit II — Nutrition, Food Science and Technology

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- Establishes why food safety and food quality are issues of global and Indian public health concern, citing NFHS 2015–16 data on diarrhoea among children under five.
- Defines the core vocabulary CUET frequently tests: food safety, toxicity, hazard, contamination, adulteration, food quality.
- Classifies hazards into physical, chemical and biological — and within biological, distinguishes food infection (Salmonella) from food intoxication (Staphylococcus aureus).
- Covers the four-level food standards system (Company, National, Regional, International), Indian regulators (FSSAI under FSSA 2006, BIS-ISI, Agmark, PFA 1954) and international bodies (CAC, ISO, WTO).
- Explains Food Safety Management Systems — GMP, GHP and HACCP — and surveys career avenues in food safety.

📖 Detailed Notes

2.1 Core concepts

- According to the National Family Health Survey 2015–16, more than 9 lakh children less than five years of age suffered from acute diarrhoea in India, making food-borne illness a major public-health and economic-growth concern (NCERT §Introduction, p. 75–76).
- Food safety and quality have gained importance because of changing lifestyles (more eating out, bulk handling), processed and packaged foods, pre-packaged spices, complex logistics, microbial adaptations and antibiotic resistance, WTO membership obligations and rising pollution/additive use (NCERT §Significance, p. 76–77).
- Nearly half of all known food-borne pathogens have been discovered in the past 25–30 years, making detection of emerging pathogens a global priority (NCERT §Significance, p. 77).
- **Food safety** is the assurance that food is acceptable for human consumption according to its intended use; understanding it requires the linked ideas of toxicity and hazard (NCERT §Basic Concepts — Food Safety, p. 77).

- **Toxicity** is the capacity of a substance to produce harm or injury of any kind under any conditions; **hazard** is the relative probability that harm or injury will result when the substance is not used in a prescribed manner and quantity (NCERT §Basic Concepts, p. 77).
- Hazards are of three kinds — **physical** (wood, stones, parts of pests, hair, etc., Fig. 6.1), **chemical** (pesticides, chemical residues, toxic metals, polychlorinated biphenyls, preservatives, food colours and other additives, Fig. 6.2) and **biological** (living organisms, including micro-organisms termed food-borne pathogens, Figs. 6.3–6.4) (NCERT §Basic Concepts, p. 78–79).
- Food-borne microbial diseases are of two types — **food infection / food poisoning** (ingestion of live pathogens, classic example Salmonella — found in animal intestinal tract, raw milk, eggs; doubles every 20 minutes; symptoms diarrhoea, fever, abdominal cramps) and **food intoxication** (toxin produced by bacteria such as Staphylococcus aureus persists even after the pathogen is killed; toxins can NOT be detected by smell, appearance or taste) (NCERT §Basic Concepts, p. 81).
- Parasites cause infestation (e.g., tape worm in pork) and pests/insects can also infest food (Fig. 6.5) (NCERT §Basic Concepts, p. 81).
- New/emerging pathogens such as **Norovirus, Rotavirus and Hepatitis E** account for about **70 per cent** of cases of food-borne disease of unknown etiology (NCERT §Basic Concepts, p. 82).
- **Contamination** is the presence of harmful or objectionable foreign substances such as chemicals, micro-organisms or dilutants before/during/after processing or storage; **adulteration** lowers food quality by adding inferior material or extracting valuable ingredient; **adulterants** are substances that make food unsafe for human consumption (NCERT §Basic Concepts, p. 82).
- **Food quality** is a holistic concept integrating nutritional traits, sensorial properties (colour, texture, shape, appearance, taste, flavour, odour), social considerations and safety; safety is a precursor of quality (NCERT §Basic Concepts — Food Quality, p. 82).
- Five salient points for food service providers: quality of raw materials and water; cleanliness of premises, personnel, equipment, food prep, storage, serving; storage at appropriate temperature; food hygiene; good service practices (NCERT §Basic Concepts, p. 83).
- **Food standards** exist at four well-coordinated levels — **Company Standards**, **National Standards** (issued by FSSAI in India), **Regional Standards** (regional groupings with similar geography/climate) and **International Standards** (ISO and Codex Alimentarius Commission) (NCERT §Food Standards, p. 83–84).
- In India: voluntary certification through **ISI mark** of Bureau of Indian Standards (BIS) for processed foods and **Agmark** for agricultural products (raw and processed); statutory framework consolidated under **Food Safety and Standards Act (FSSA),**

2006, which established **FSSAI** to lay down science-based standards and shifts Indian food law from compositional/vertical standards to safety/horizontal standards (NCERT §Food Standards and Regulations in India, p. 84).

- FSSAI functions include framing regulations, accrediting certification bodies and laboratories, scientific advice to governments, data collection on contaminants, rapid alert systems, public information network, training, contributing to international sanitary/phyto-sanitary standards (NCERT §FSSAI box, p. 84–85).
- International bodies: **Codex Alimentarius Commission (CAC)** — intergovernmental, 187 member countries + EU in 2017, India represented through Ministry of Health & Family Welfare; **ISO** — non-governmental federation, ISO 9000 covers Quality Management, voluntary; **WTO** — established 1995, administers trade agreements (NCERT §International Organisations, p. 85–87).
- **Differences between Codex and ISO:** Codex is used to develop national regulations, slow to change, describes minimal acceptable practices; ISO is voluntary, reviewed every five years, describes current standard industrial practices (NCERT Table p. 87).
- **Prevention of Food Adulteration Act (PFA), 1954** was enacted by Government of India and has been amended over 200 times; related Orders include Fruit and Vegetable Product Order, Meat Food Products Order and Vegetable Oil Products Order — all consolidated under FSSA (NCERT box p. 86).
- An effective **Food Control System** requires (i) Food Inspection and (ii) Analytical capability (well-equipped accredited laboratories) (NCERT §WTO/Food Control, p. 87).
- **Food Safety Management Systems**: GMP (proactive quality assurance to ensure products are safe and not falsely labelled), GHP (farm-to-consumer hygiene approach), and **HACCP** (Hazard Analysis Critical Control Point — identifies hazards, assesses occurrence at each stage of the food chain, defines control measures; preventive rather than end-product testing) (NCERT §Food Safety Management Systems, p. 87–88).
- Under FSSA 2006, primary responsibility for safe food lies with producers and suppliers through HACCP, GMP and GHP (NCERT §HACCP advantages, p. 89).
- **Scope:** India's food industry accounts for about **26 per cent of GDP**; career avenues include quality control analysts, food legislators, food safety officers, food analysts, auditors, ISO/Agmark/BIS jobs, HACCP specialists, teaching, research and entrepreneurship in analytical food labs and food safety consultancy (NCERT §Scope and Career Avenues, p. 89–90).

Food Quality and Food Safety is the regulatory-and-systems area of Class XII Nutrition. Where Clinical Nutrition addresses individual patients and Public Nutrition addresses populations, this covers the food system as a whole — from farm to fork — and the institutional architecture that makes food trustworthy. It is a definition-and-regulator goldmine for CUET.

The anchor concept is the trio toxicity-hazard-food safety. Toxicity is intrinsic — every substance has some capacity to harm; even water can be toxic in extreme amounts. Hazard is contextual — it is the probability that harm will materialise given a specific manner and quantity of use. Food safety is the assurance that food, as actually used, will not harm. The three are not synonyms, and CUET routinely tests their precise definitions.

Three hazard classes: Physical (foreign objects — stones, hair, glass, metal fragments, plastic pieces, insect parts), Chemical (pesticide residues; veterinary drug residues; heavy metals — lead, mercury, cadmium, arsenic; PCBs; mycotoxins like aflatoxin from groundnut/maize; food additives misused; cleaning-agent residues), and Biological (bacteria, viruses, fungi, parasites, prions, visible pests). The Indian context has unique chemical-hazard exposure — pesticide residues in fruits/vegetables (the focus of FSSAI's MRL standards), milk adulteration (urea, detergent, hydrogen peroxide), edible-oil adulteration with argemone oil (the cause of the 1998 dropsy epidemic), and metanil yellow in turmeric.

Food infection vs food intoxication is the most-tested distinction here. Food infection (also called food poisoning in NCERT) requires live pathogenic organisms entering and multiplying in the body — Salmonella (poultry, eggs, milk), Campylobacter, E. coli O157:H7, Listeria monocytogenes, Shigella. Salmonella's 20-minute doubling time means that a single cell at 5 PM can produce billions of cells by morning if the food is left at room temperature. Food intoxication involves toxins pre-formed in the food by bacteria — Staphylococcus aureus (heat-stable enterotoxin), Clostridium botulinum (deadly neurotoxin in improperly canned foods), Bacillus cereus (rice — 'fried-rice syndrome'). The intoxication toxins survive cooking because they are heat-stable; reheating cannot rescue the food.

Emerging food-borne pathogens — Norovirus (the leading cause of cruise-ship outbreaks; sandwiches, ready-to-eat food), Rotavirus (the main cause of childhood diarrhoea in India before vaccination), Hepatitis E (water-borne in India) — together account for ~70% of food-borne illness of unknown etiology.

Contamination is the unintended presence of a foreign substance; adulteration is the intentional debasement of food (adding water to milk, chicory to coffee, brick powder to chilli, papaya seeds to black pepper, melamine to milk powder). Adulterants are deliberately added substances that compromise safety. The framework of food quality is holistic — integrating nutritional content, sensory properties (colour, texture, shape, appearance, taste, flavour, odour), social/cultural acceptability, and safety. NCERT places safety as the precondition of quality — an unsafe food, however nutritionally rich, cannot be called 'high quality'.

The four levels of food standards (Company → National → Regional → International) anchor regulatory architecture. In India, the legacy of the Prevention of Food Adulteration Act 1954 (PFA) and its orders (FPO for fruit & vegetable products, MFPO for meat, VOPO for vegetable oils) was consolidated by the Food Safety and Standards

Act 2006 (FSSA), which created the FSSAI (Food Safety and Standards Authority of India) headquartered in New Delhi, with regional offices across India. FSSAI shifted Indian food law from compositional/vertical standards (prescribing percentages of ingredients) to safety/horizontal standards (prescribing hazard-free outcomes). The voluntary marks remain: ISI (BIS) for processed foods; Agmark for agricultural produce (raw and processed). The mandatory FSSAI registration/licence applies to all food businesses (Basic, State, Central tiers by turnover).

International bodies include the Codex Alimentarius Commission (CAC) — jointly run by FAO and WHO since 1963, with 187+ member countries as of 2017, headquartered in Rome, develops Codex standards used worldwide and within WTO; India is a member via the Ministry of Health & Family Welfare. ISO (International Organization for Standardization) — Geneva-based, non-governmental federation of national standards bodies (BIS is India's representative); ISO 9000 series covers Quality Management Systems; ISO 22000 covers food safety; ISO standards are voluntary and reviewed every 5 years. WTO (1995) administers SPS (Sanitary and Phyto-sanitary) and TBT (Technical Barriers to Trade) agreements that constrain trade-related food rules.

Food Safety Management Systems: GMP (Good Manufacturing Practices) — proactive process standards covering premises, personnel, equipment, materials, processes, records; GHP (Good Hygiene Practices) — farm-to-fork hygiene standards covering personal hygiene, cleaning/sanitation, pest control, waste disposal; HACCP (Hazard Analysis and Critical Control Points) — seven-principle preventive system identifying critical control points (CCPs), establishing critical limits, monitoring, corrective action, verification, record-keeping. Under FSSA 2006, the primary responsibility for safe food lies with producers/suppliers through HACCP/GMP/GHP — a shift from end-product testing to systemic prevention.

2.2 Definitions to memorise

Term	Definition	Page
Food safety	Assurance that food is acceptable for human consumption according to its intended use	77
Toxicity	Capacity of a substance to produce harm or injury of any kind under any conditions	77
Hazard	Relative probability that harm or injury will result when substance is not used in prescribed manner and quantity	77
Physical hazard	Any physical material not normally found in food (wood, stones, parts of pests, hair)	78
Chemical hazard	Chemicals or deleterious substances intentionally or un-intentionally added to food (pesticides, residues, toxic metals, PCBs, preservatives, food colours, additives)	79
Biological hazard	Living organisms including micro-organisms (food-borne pathogens)	79

Term	Definition	Page
Food infection / Food poisoning	Disease from ingestion of live pathogenic organisms that multiply in the body (e.g., Salmonella)	81
Food intoxication	Disease from toxins produced by bacteria in food, even after the pathogen is killed (e.g., Staphylococcus aureus)	81
Contamination	Presence of harmful/objectionable foreign substances in food before/during/after processing or storage	82
Adulteration	Lowering food quality by adding inferior material or extracting valuable ingredient	82
Adulterants	Substances used to make food products unsafe for human consumption	82
Food quality	Holistic attribute integrating nutrition, sensory properties, social considerations and safety	82
HACCP	Hazard Analysis Critical Control Point — preventive system identifying and controlling hazards at each stage of the food chain	88

2.3 Diagrams / processes to remember

- **Fig. 6.1 — Physical hazards in food** (p. 78): wood, stones, hair, buttons, jewellery, nails, matchsticks, insect parts, etc.
- **Fig. 6.2 — Chemical hazards in food** (p. 79): pesticides, chemical residues, toxic metals, PCBs, preservatives, food colours, additives.
- **Fig. 6.3 — Visible biological hazards** (p. 80): worms, flies, cockroaches, beetles, caterpillars.
- **Fig. 6.4 — Invisible/microbiological hazards** (p. 80): bacteria, viruses, moulds, yeast, parasites.
- **Fig. 6.5 — Infestation of foods** (p. 81): kitchen contamination by rats, flies.
- **Fig. 6.6 — Job opportunities in food industry** (p. 90).
- **Codex vs ISO comparison table** (p. 87).

2.5 Key data / food-safety regulatory table (Indian context)

Item	Value / fact	Source
NFHS 2015-16 under-5 diarrhoea cases	>9 lakh	NCERT p. 76
Newly discovered food pathogens (past 25–30 yrs)	~50% of total	NCERT p. 77
Three hazard classes	Physical; Chemical; Biological	NCERT pp. 78–79
Salmonella doubling time	~20 minutes	NCERT p. 81

Item	Value / fact	Source
Classic infection example	Salmonella	NCERT p. 81
Classic intoxication example	Staphylococcus aureus	NCERT p. 81
Norovirus + Rotavirus + Hep E share	~70% of unknown-aetiology cases	NCERT p. 82
Four levels of food standards	Company; National; Regional; International	NCERT pp. 83–84
Indian national regulator	FSSAI (under FSSA 2006)	NCERT p. 84
Indian voluntary mark (processed)	ISI (BIS)	NCERT p. 84
Indian voluntary mark (agricultural)	Agmark	NCERT p. 84
Old PFA Act year	1954	NCERT p. 86
FSSA year	2006	NCERT p. 84
Codex Alimentarius members (2017)	187 + EU	NCERT p. 85
Codex headquarters	Rome (FAO + WHO)	India context
India's Codex contact ministry	Ministry of Health & Family Welfare	NCERT p. 85
ISO headquarters	Geneva (India context)	India context
ISO 9000 series	Quality Management	NCERT p. 86
ISO 22000 series	Food Safety Management (India context)	India context
WTO establishment	1995	NCERT p. 87
Three food safety management systems	GMP; GHP; HACCP	NCERT p. 87
HACCP type	Preventive (not end-product testing)	NCERT p. 88
Indian food industry share of GDP (this chapter)	~26%	NCERT p. 89

2.4 Common confusions / NTA trap points

- **Food infection vs food intoxication** — infection needs live organism in the body (Salmonella); intoxication is caused by toxin and survives even when the pathogen is destroyed (Staphylococcus aureus). NTA loves swapping the two examples.
- **Toxicity vs hazard** — toxicity is an inherent capacity; hazard is a probability of harm when not used correctly. They are not synonyms.
- **Contamination vs adulteration** — contamination is presence of foreign substances; adulteration is the intentional lowering of quality (addition of inferior material or extraction of valuable ingredient).
- **ISI mark (BIS) vs Agmark** — ISI is for processed foods; Agmark is for agricultural products (raw and processed). Both are voluntary.

- **FSSA 2006 vs PFA 1954** — FSSA consolidates PFA and other Orders under one umbrella; FSSAI is the body established under FSSA, not under PFA.
- **Codex vs ISO** — Codex develops national regulations and is slow to change; ISO is voluntary, reviewed every 5 years.
- Norovirus, Rotavirus, Hepatitis E together account for about **70 per cent** of cases of unknown-etiology food-borne illness — not 50 per cent.
- ISO 9000 = quality management; ISO 22000 = food safety — don't conflate.
- Codex Alimentarius is run jointly by FAO + WHO — not by WTO.
- HACCP is **preventive**; end-product testing is reactive — a frequent assertion-reason setup.
- FSSAI is set up under **FSSA 2006**, not under PFA 1954.

🎯 Practice MCQs

📊 PYQ Alignment

This chapter is one of the highest-yielding parts of CUET Home Science Unit II, typically producing 8–10 MCQs across each year's paper. NTA repeatedly tests definitions (toxicity vs hazard, contamination vs adulteration), the infection-vs-intoxication contrast with Salmonella and Staphylococcus aureus as named examples, FSSAI/FSSA 2006 facts, the four-level standards hierarchy, the ISI/Agmark/Codex/ISO regulatory bodies, and HACCP/GMP/GHP as food safety management systems.