

Food safety

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Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent foodborne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards. In this way food safety often overlaps with food defense to prevent harm to consumers. The tracks within this line of thought are safety between industry and the market and then between the market and the consumer. In considering industry to market practices, food safety considerations include the origins of food including the practices relating to food labeling, food hygiene, food additives and pesticide residues, as well as policies on biotechnology and food and guidelines for the management of governmental import and export inspection and certification systems for foods. In considering market to consumer practices, the usual thought is that food ought to be safe in the market and the concern is safe delivery and preparation of the food for the consumer.

Food safety



Terms

Foodborne illness

Hazard analysis and critical control points (HACCP) • Hazard analysis and risk-based preventive controls (HARPC)

Critical control point

Critical factors

FAT TOM

pH

Water activity (a_w)

Bacterial pathogens

Clostridium botulinum

Escherichia coli

Listeria

Salmonella

Vibrio cholerae

Viral pathogens

Enterovirus

Hepatitis A

Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. In developed countries there are intricate standards for food preparation, whereas in lesser developed countries the main issue is simply the availability of adequate safe water, which is

usually a critical item.^[1] In theory, food poisoning is 100% preventable. The five key principles of food hygiene, according to WHO, are:^[2]

1. Prevent contaminating food with pathogens spreading from people, pets, and pests.
2. Separate raw and cooked foods to prevent contaminating the cooked foods.
3. Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens.
4. Store food at the proper temperature.
5. Do use safe water and safe raw materials.

Norovirus
Rotavirus
Parasitic pathogens
Cryptosporidium
Entamoeba histolytica
Giardia
Trichinella

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Issues

Food safety issues and regulations concern:

- Agriculture and animal husbandry practices
- Food manufacturing practices
- Food additives
- Novel foods
- Genetically modified foods
- Food labels

ISO 22000

ISO 22000 is a standard developed by the International Organization for Standardization dealing with food safety. This is a general derivative of ISO 9000. ISO 22000 standard: The ISO 22000 international standard specifies the requirements for a food safety management system that involves **interactive communication, system management, prerequisite programs, HACCP principles**.

Incidence

A 2003 World Health Organization (WHO) report concluded that about 30% of reported food poisoning outbreaks in the WHO European Region occur in private homes.^[3] According to the WHO and CDC, in the USA alone, annually, there are 76 million cases of foodborne illness leading to 325,000 hospitalizations and 5,000 deaths.^[4]

Regulations by jurisdiction and agency

WHO and FAO

In 1963, the WHO and FAO published the Codex Alimentarius which serves as an guideline to food safety.^[5]

However, according to Unit 04 - Communication of Health & Consumers Directorate-General of the European Commission (SANCO): "The Codex, while being recommendations for voluntary application by members, Codex standards serve in many cases as a basis for national legislation. The reference made to Codex food safety standards in the World Trade Organizations' Agreement on Sanitary and Phytosanitary measures (SPS Agreement) means that Codex has far reaching implications for resolving trade disputes. WTO members that wish to apply stricter food safety measures than those set by Codex may be required to justify these measures scientifically." So, an agreement made in 2003, signed by all member states, inclusive all EU, in the codex Stan Codex 240 – 2003 (http://www.codexalimentarius.org/input/download/standards/10401/CXS_240e.pdf) for coconut milk, sulphite containing additives like E223 and E 224 are allowed till 30 mg/kg, does NOT mean, they are allowed into the EU, see RASFF entries from Denmark: 2012.0834 (<https://webgate.ec.europa.eu/rasff-window/portal/index.cfm?>

event=searchResultList); 2011.1848; en 2011.168, “sulphite unauthorised in coconut milk from Thailand “. Same for polysorbate E 435: see 2012.0838 from Denmark, unauthorised polysorbates in coconut milk and, 2007.AIC from France. Only for the latter the EU amended its regulations with (EU) No 583/2012 (<http://faolex.fao.org/docs/pdf/eur114056.pdf>) per 2 July 2012 to allow this additive, already used for decades and absolutely necessary.

Australia

Food Standards Australia New Zealand requires all food businesses to implement food safety systems. These systems are designed to ensure food is safe to consume and halt the increasing incidence of food poisoning, and they include basic food safety training for at least one person in each business. Food safety training is delivered in various forms by, among other organisations, Registered Training Organizations (RTOs), after which staff are issued a nationally recognised unit of competency code on their certificate. Basic food safety training includes:

- Understanding the hazards associated with the main types of food and the conditions to prevent the growth of bacteria which can cause food poisoning and to prevent illness.
- Potential problems associated with product packaging such as leaks in vacuum packs, damage to packaging or pest infestation, as well as problems and diseases spread by pests.
- Safe food handling. This includes safe procedures for each process such as receiving, re-packing, food storage, preparation and cooking, cooling and re-heating, displaying products, handling products when serving customers, packaging, cleaning and sanitizing, pest control, transport and delivery. Also covers potential causes of cross contamination.
- Catering for customers who are particularly at risk of food-borne illness, as well as those with allergies or intolerance.
- Correct cleaning and sanitizing procedures, cleaning products and their correct use, and the storage of cleaning items such as brushes, mops and cloths.
- Personal hygiene, hand washing, illness, and protective clothing.

Food safety standards and requirements are set out at the national level in the Food Standards Code, and brought into force in each state by state-based Acts and Regulations. Legislation means that people responsible for selling or serving unsafe food may be liable for heavy fines.

China

Food safety is a growing concern in Chinese agriculture. The Chinese government oversees agricultural production as well as the manufacture of food packaging, containers, chemical additives, drug production, and business regulation. In recent years, the Chinese government attempted to consolidate food regulation with the creation of the State Food and Drug Administration in 2003, and officials have also been under increasing public and international pressure to solve food safety problems. However, it appears that regulations are not well known by the trade. Labels used for "green" food, "organic" food and "pollution-free" food are not well recognized by traders and many are unclear about their meaning. A survey by the World Bank found that supermarket managers had difficulty in obtaining produce that met safety requirements and found that a high percentage of produce did not comply with established standards.^[6]

Traditional marketing systems, whether in China or the rest of Asia, presently provide little motivation or incentive for individual farmers to make improvements to either quality or safety as their produce tends to get grouped together with standard products as it progresses through the marketing channel. Direct linkages between farmer groups and traders or ultimate buyers, such as supermarkets, can help avoid this problem. Governments need to improve the condition of many markets through upgrading management and reinvesting market fees in physical infrastructure. Wholesale markets need to investigate the feasibility of developing separate sections to handle fruits and vegetables that meet defined safety and quality standards.^[7]

European Union

The parliament of the European Union (EU) makes legislation in the form of directives and regulations, many of which are mandatory for member states and which therefore must be incorporated into individual countries' national legislation. As a very large organisation that exists to remove barriers to trade between member states, and into which individual member states have only a proportional influence, the outcome is often seen as an excessively bureaucratic 'one size fits all' approach. However, in relation to food safety the tendency to err on the side of maximum protection for the consumer may be seen as a positive benefit. The EU parliament is informed on food safety matters by the European Food Safety Authority.

Individual member states may also have other legislation and controls in respect of food safety, provided that they do not prevent trade with other states, and can differ considerably in their internal structures and approaches to the regulatory control of food safety.

From 13 December 2014, new legislation - the EU Food Information for Consumers Regulation 1169/2011 - require food businesses to provide allergy information on food sold unpackaged, in for example catering outlets, deli counters, bakeries and sandwich bars.^[8]

France

Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (anses) is a French governmental agency dealing with food safety.

Germany

The Federal Ministry of Food, Agriculture and Consumer Protection (BMEL)^[9] is a Federal Ministry of the Federal Republic of Germany. **History:** Founded as Federal Ministry of Food, Agriculture and Forestry in 1949, this name did not change until 2001. Then the name changed to Federal Ministry of Consumer Protection, Food and Agriculture. At the 22nd of November 2005, the name got changed again to its current state: Federal Ministry of Food, Agriculture and Consumer Protection. The reason for this last change was that all the resorts should get equal ranking which was achieved by sorting the resorts alphabetically. **Vision:** A balanced and healthy diet with safe food, distinct consumer rights and consumer information for various areas of life, and a strong and sustainable agriculture as well as perspectives for our rural areas are important goals of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The Federal Office of Consumer Protection and Food Safety is under the control of the Federal Ministry of Food, Agriculture and Consumer Protection. It exercises several duties, with which it contributes to safer food and thereby intensifies health-based consumer protection in Germany. Food can be manufactured and sold within Germany without a special permission, as long as it does not cause any damage on consumers' health and meets the general standards set by the legislation. However, manufacturers, carriers, importers and retailers are responsible for the food they pass into circulation. They are obliged to ensure and document the safety and quality of their food with the use of in-house control mechanisms.

Hong Kong

In Hong Kong SAR, the Centre for Food Safety is in charge of ensuring food sold is safe and fit for consumption.

India

Food Safety and Standards Authority of India, established under the Food Safety and Standards Act, 2006, is the regulating body related to food safety and laying down of standards of food in India.

New Zealand

The New Zealand Food Safety Authority (NZFSA), or Te Pou Oranga Kai O Aotearoa is the New Zealand government body responsible for food safety. NZFSA is also the controlling authority for imports and exports of food and food-related products. The NZFSA as of 2012 is now a division of the Ministry for Primary Industries (MPI) and is no longer its own organization.

Pakistan

Pakistan does not have an integrated legal framework but has a set of laws, which deals with various aspects of food safety. These laws, despite the fact that they were enacted long time ago, have tremendous capacity to achieve at least minimum level of food safety. However, like many other laws, these laws remain very poorly enforced. There are four laws that specifically deal with food safety. Three of these laws directly focus issues related to food safety, while the fourth, the Pakistan Standards and Quality Control Authority Act, is indirectly relevant to food safety.

The Pure Food Ordinance 1960 consolidates and amends the law in relation to the preparation and the sale of foods. All provinces and some northern areas have adopted this law with certain amendments. Its aim is to ensure purity of food being supplied to people in the market and, therefore, provides for preventing adulteration. The Pure Food Ordinance 1960 does not apply to cantonment areas. There is a separate law for cantonments called "The Cantonment Pure Food Act, 1966". There is no substantial difference between the Pure Food Ordinance 1960 and The Cantonment Pure Food Act. Even the rules of operation are very much similar.

Pakistan Hotels and Restaurant Act, 1976 applies to all hotels and restaurants in Pakistan and seeks to control and regulate the rates and standard of service(s) by hotels and restaurants. In addition to other provisions, under section 22(2), the sale of food or beverages that are contaminated, not prepared hygienically or served in utensils that are not hygienic or clean is an offense. There are no express provisions for consumer complaints in the Pakistan Restaurants Act, 1976, Pakistan Penal Code, 1860 and Pakistan Standards and Quality Control Authority Act, 1996. The laws do not prevent citizens from lodging complaints with the concerned government officials; however, the consideration and handling of complaints is a matter of discretion of the officials.^[10]

South Korea

Korea Food & Drug Administration

Korea Food & Drug Administration (KFDA)^[11] is working for food safety since 1945. It is part of the Government of South Korea.

IOAS^[12]-Organic Certification Bodies Registered in KFDA: "Organic" or related claims can be labelled on food products when organic certificates are considered as valid by KFDA. KFDA admits organic certificates which can be issued by 1) IFOAM (International Federation of Organic Agriculture Movement) accredited certification bodies 2) Government accredited certification bodies – 328 bodies in 29 countries have been registered in KFDA.

Food Import Report: According to Food Import Report,^[13] it is supposed to report or register what you import. Competent authority is as follows:

Product	Authority
Imported Agricultural Products, Processed Foods, Food Additives, Utensils, Containers & Packages or Health Functional Foods	KFDA (Korea Food and Drug Administration)
Imported Livestock, Livestock products (including Dairy products)	NVRQS (National Veterinary Research and Quarantine Service)
Packaged meat, milk & dairy products (butter, cheese), hamburger patties, meat ball and other processed products which are stipulated by Livestock Sanitation Management Act	NVRQS (National Veterinary Research and Quarantine Service)
Imported Marine products; fresh, chilled, frozen, salted, dehydrated, eviscerated marine produce which can be recognized its characteristics	NFIS (National Fisheries Products Quality Inspection Service)

National Institute of Food and Drug Safety Evaluation

National Institute of Food and Drug Safety Evaluation (NIFDS)^[14] is functioning as well. The National Institute of Food and Drug Safety Evaluation is a national organization for toxicological tests and research. Under the Korea Food & Drug Administration, the Institute performs research on toxicology, pharmacology, and risk analysis of foods, drugs, and their additives. The Institute strives primarily to understand important biological triggering mechanisms and improve assessment methods of human exposure, sensitivities, and risk by (1) conducting basic, applied, and policy research that closely examines biologically triggering harmful effects on the regulated products such as foods, food additives, and drugs, and operating the national toxicology program for the toxicological test development and inspection of hazardous chemical substances assessments. The Institute ensures safety by investigation and research on safety by its own researchers, contract research by external academicians and research centers.

Taiwan

In Taiwan, the Ministry of Health and Welfare in charge of Food and Drug Safety, also evaluate the catering industry to maintenance the food product quality.^[15] Currently, US\$29.01 million of budget is allocated each year for food safety-related efforts.^[16]

United Kingdom

In the UK the Food Standards Agency is an independent government department responsible for food safety and hygiene across the UK.^[17] They work with businesses to help them produce safe food, and with local authorities to enforce food safety regulations. In 2006 food hygiene legislation changed and new requirements came into force. The main requirement resulting from this change is that if you own or run a food business in the UK, you must have a documented Food Safety Management System, which is based on the principles of Hazard Analysis Critical Control Point HACCP.^[18]

United States

The US food system is regulated by numerous federal, state and local officials. It has been criticized as lacking in "organization, regulatory tools, and not addressing food borne illness."^[19]

Federal level regulation

The Food and Drug Administration publishes the Food Code, a model set of guidelines and procedures that assists food control jurisdictions by providing a scientifically sound technical and legal basis for regulating the retail and food service industries, including restaurants, grocery stores and institutional foodservice providers such as nursing homes. Regulatory agencies at all levels of government in the United States use the FDA Food Code to develop or update food safety rules in their jurisdictions that are consistent with national food regulatory policy. According to the FDA, 48 of 56 states and territories, representing 79% of the U.S. population, have adopted food codes patterned after one of the five versions of the Food Code, beginning with the 1993 edition.^[20]

In the United States, federal regulations governing food safety are fragmented and complicated, according to a February 2007 report from the Government Accountability Office.^[21] There are 15 agencies sharing oversight responsibilities in the food safety system, although the two primary agencies are the U.S. Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS), which is responsible for the safety of meat, poultry, and processed egg products, and the Food and Drug Administration (FDA), which is responsible for virtually all other foods.

The Food Safety and Inspection Service has approximately 7,800 inspection program personnel working in nearly 6,200 federally inspected meat, poultry and processed egg establishments. FSIS is charged with administering and enforcing the Federal Meat Inspection Act, the Poultry Products Inspection Act, the Egg Products Inspection Act, portions of the Agricultural Marketing Act, the Humane Slaughter Act, and the regulations that implement these laws. FSIS inspection program personnel inspect every animal before slaughter, and each carcass after slaughter to ensure public health requirements are met. In fiscal year (FY) 2008, this included about 50 billion pounds of livestock carcasses, about 59 billion pounds of poultry carcasses, and about 4.3 billion pounds of processed egg products. At U.S. borders, they also inspected 3.3 billion pounds of imported meat and poultry products.^[22]

Industry pressure

There have been concerns over the efficacy of safety practices and food industry pressure on U.S. regulators. A study reported by Reuters found that "the food industry is jeopardizing U.S. public health by withholding information from food safety investigators or pressuring regulators to withdraw or alter policy designed to protect consumers". A survey found that 25% of U.S. government inspectors and scientists surveyed have experienced during the past year corporate interests forcing their food safety agency to withdraw or to modify agency policy or action that protects consumers. Scientists have observed that management undercuts field inspectors who stand up for food safety against industry pressure. According to Dr. Dean Wyatt, a USDA veterinarian who oversees federal slaughter house inspectors, "Upper level management does not adequately support field inspectors and the actions they take to protect the food supply. Not only is there lack of support, but there's outright obstruction, retaliation and abuse of power."^[23] A growing number of

food and beverage manufacturers are improving food safety standards by incorporating a food safety management system which automates all steps in the food quality management process.^[24]

State and local regulation

A number of U.S. states have their own meat inspection programs that substitute for USDA inspection for meats that are sold only in-state.^[25] Certain state programs have been criticized for undue leniency to bad practices.^[26]

However, other state food safety programs supplement, rather than replace, Federal inspections, generally with the goal of increasing consumer confidence in the state's produce. For example, state health departments have a role in investigating outbreaks of food-borne disease bacteria, as in the case of the 2006 outbreak of *Escherichia coli* O157:H7 (a pathogenic strain of the ordinarily harmless bacteria, *E. coli*) from processed spinach.^[27] Health departments also promote better food processing practices to eliminate these threats.^[28]

In addition to the US Food and Drug Administration, several states that are major producers of fresh fruits and vegetables (including California, Arizona and Florida) have their own state programs to test produce for pesticide residues.^[29]

Restaurants and other retail food establishments fall under state law and are regulated by state or local health departments. Typically these regulations require official inspections of specific design features, best food-handling practices, and certification of food handlers.^[30] In some places a letter grade or numerical score must be prominently posted following each inspection.^[31] In some localities, inspection deficiencies and remedial action are posted on the Internet.^[32]

Vietnam

The Vietnam Food Administration is responsible for managing food hygiene, safety, and quality and has made significant progress since its establishment in 1999. Food safety remains a high priority in Vietnam with the growth of export markets and increasing food imports raising the need to rapidly build capacity of the Food Administration in order to reduce threats of foodborne disease. The Food

Administration has demonstrated commitment to the food safety challenges it faces, and has embarked on an innovative capacity building activity with technical assistance from the World Health Organization.^[33]

Manufacturing control

HACCP guidelines

Consumer labeling

United Kingdom

Foodstuffs in the UK have one of two labels to indicate the nature of the deterioration of the product and any subsequent health issues. EHO Food Hygiene certification is required to prepare and distribute food. While there is no specified expiry date of such a qualification the changes in legislation it is suggested to update every five years.

Best before indicates a future date beyond which the food product *may* lose quality in terms of taste or texture amongst others, but does not imply any serious health problems if food is consumed beyond this date (within reasonable limits).

Use by indicates a legal date beyond which it is not permissible to sell a food product (usually one that deteriorates fairly rapidly after production) due to the potential serious nature of consumption of pathogens. Leeway is sometimes provided by producers in stating **display until** dates so that products are not at their limit of safe consumption on the actual date stated (this latter is voluntary and not subject to regulatory control). This allows for the variability in production, storage and display methods.

United States

With the exception of infant formula and baby foods which must be withdrawn by their expiration date, Federal law does not require expiration dates. For all other foods, except dairy products in some states, freshness dating is strictly voluntary on the part of manufacturers. In response to consumer demand, perishable foods are typically labelled with a **Sell by** date.^[34] It is up to the consumer to decide how long

after the Sell by date a package is usable. Other common dating statements are **Best if used by**, **Use-by date**, **Expiration date**, **Guaranteed fresh <date>**, and **Pack date**.^[35]

Australia and New Zealand

Guide to Food Labelling and Other Information Requirements: This guide provides background information on the general labelling requirements in the Code. The information in this guide applies both to food for retail sale and to food for catering purposes. Foods for catering purposes means those foods for use in restaurants, canteens, schools, caterers or self-catering institutions, where food is offered for immediate consumption. Labelling and information requirements in the new Code apply both to food sold or prepared for sale in Australia and New Zealand and food imported into Australia and New Zealand. Warning and Advisory Declarations, Ingredient Labelling, Date Marking, Nutrition Information Requirements, Legibility Requirements for Food Labels, Percentage Labelling, Information Requirements for Foods Exempt from Bearing a Label.^{[36][37]}

See also

- Adulterated food
- Aseptic processing
- Codex Alimentarius
- Danger zone (food safety)
- Five-second rule
- *Food and Bioprocess Technology*
- Food chemistry
- Food engineering
- Food grading
- Food microbiology
- Food rheology
- Food spoilage
- Food technology
- International Food Safety Network
- ISO 22000
- Food sampling
- Optical sorting

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Journals

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- *Food Control*, ISSN 0956-7135 (<https://www.worldcat.org/search?fq=x0:jrnl&q=n2:0956-7135>), Elsevier
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- *Internet Journal of Food Safety*, ISSN 1930-0670 (<https://www.worldcat.org/search?fq=x0:jrnl&q=n2:1930-0670>), International Association for Food Safety/Quality

External links

- U.S. Food Safety and Inspection Service (FSIS) (<http://www.fsis.usda.gov/>)
- The Food Standards Agency UK (<http://www.foodstandards.gov.uk/>)
- Safer Food Better Business – practical food safety for small caterers and retailers (<http://www.food.gov.uk/sfbb>) developed by the UK Food Standards Agency
- Korea Food & Drug Administration (KFDA) (<http://eng.kfda.go.kr/>)
- <http://www.foodlink.org.uk/>
- Food Safety Information Center at the USDA National Agricultural Library (<http://foodsafety.nal.usda.gov/>)
- Health-EU Portal (http://ec.europa.eu/health-eu/my_environment/food_safety/index_en.htm)
- Food Safety MSc programme (<http://www.mfs.wur.nl/>)
- Food Safety Discussion Forum (<http://www.ifsqn.com/forum/>)
- State Food Safety Food Handler Cards and Certifications (<http://statefoodsafety.com>)

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