# FOOD CHAIN MANAGEMENT

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**Keywords**: Food chain, food safety, agriculture, pesticides, Integrated Pest Management (IPM), Good Agricultural Practice (GAP), animal husbandry, veterinary drugs, antibiotics, nutraceuticals, food processing, Good Manufacturing Practice (GMP), Hazard Analysis and Critical Control Point (HACCP), storage, transport, distribution, food service, sanitation, cleaning, warewashing

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**Summary**

In the broader sense, the food chain includes all stages of food production, starting from plant and animal husbandry to consumption of fresh or processed foods in food services systems or at home.

Keeping in mind that agricultural and environmental aspects of food safety are treated in detail elsewhere (see *Food Safety and Environmental Sanitation*) and that the same is valid for the role of food manufacturing in assurance of safe food production (see *Food Manufacturing Practices and Sanitation*), the safety aspects of storage and distribution will be discussed here.

In addition, considerable attention is paid to sanitation and food safety in food services, and in households. Storage of raw materials, specific food handling procedures, cleaning, and sanitation are also treated.

## 1. Introduction

According to a resolution of the World Health Organization (WHO) on food safety, food safety has to be accepted by the public health community as an essential public health function. A similar view has been expressed by the European Community (EC). Consequently, food safety has to be integrated along the entire food chain. The food chain includes all stages of food production and use, starting from plant growing and animal husbandry to the consumption of fresh or processed food (meals) by consumers. It means that effective assurance of food safety needs the identification of major factors that may influence food safety: surveillance and monitoring programs, safe agricultural and manufacturing practices in agriculture and industry (including food service and catering), and at home in the kitchen. Essential cornerstones of a food safety program are legislation and its enforcement. The role of food legislation is to provide norms and guidance for industry compliance.

The environmental aspects of food safety, including good agricultural practice, integrated pest management (IPM), and the problems of sustainable development, are discussed in the framework of another chapter (see *Food Safety and Environmental Sanitation*). Detailed attention has been paid to the food safety aspects of food processing, including good manufacturing practice (GMP), and the hazard analysis critical control point (HACCP) system (see *Food Manufacturing Practices and Sanitation*).

For that reason, in this chapter, the food safety aspects of farming and industrial processing are treated, while the events occurring after the finished food product has left the food plant will be overviewed.

Special attention is paid to the safety and sanitation in food service establishments and, in the preparation of meals at home. Without acceptable hygienic conditions and practices in the kitchen, despite all efforts made in preceding parts of the food chain, full food safety cannot be achieved.

As mentioned above, legislation and its enforcement are vital for assurance of the production of safe foods and the protection of consumers. Food laws and regulations are treated in a separate chapter (see *Food Laws and Regulation).*

## 2. Good Agricultural Practice is the First Pillar of Food Safety

It is certain that an important prerequisite of the production of safe food is to use pure, uncontaminated raw materials of plant origin. (Due to potential “carry through” effect, the same requirements are valid for animal feed.) The development and use of chemicals (e.g., pesticides) in agriculture, in addition to their positive effects and benefits, result in potential health hazards because of the residues of pesticides in foods. The possible negative effects of the residues of pesticides and other chemical agents in food and feed stimulate efforts to reduce the use of chemicals in agriculture. Good agricultural practice (GAP) in the use of chemicals may be an effective tool in realizing the aim mentioned above. GAP includes—according to the Codex Alimentarius Commission (CAC)—the nationally authorized safe uses of pesticides under actual

conditions necessary for effective and reliable pest control. It encompasses a range of levels of pesticide applications up to the highest authorized use, applied in a manner that leaves the smallest residue amount practicable. The experience of developed countries shows that pesticides, when used according to good agricultural practices (GAP), do not cause harm to human health. GAP includes recommended safe uses of pesticides, taking into account public and occupational health, and environmental safety considerations. Since the 1960s, there has been much interest in and effort to develop a system of integrated pest management (IPM). IPM involves selection, integration, and implementation of pest control actions on the basis of predictable ecological, economical, and sociological consequences. Methods are selected that cause minimal environmental damage, and pose little or no risk to human health. Cultivar selection and planting dates, cultural practices, predicted weather, the level of existing biological agents, stages of plant development, and so on, are taken into account using the IPM system (see *Food Safety and Environmental Sanitation*).

Among potential ways to reduce the amount of chemicals used in agriculture, the development of new and more effective pesticides should also be mentioned. The recommended dose of organophosphate pesticides is 4 kg/ha to 5 kg/ha; for carbamate pesticides 1 kg/ha to 1.5 kg/ha; pyrethroids were found to be potent in a dose ranging from 50 g/ha to 500 g/ha, and research reported new pesticides to be potent in an amount of 25 mg/ha.

Organic farming provides the possibility of excluding pesticide residues from food. Although the sales of organic food are steadily growing (e.g., in the US in 1999 sales increased 24% and reached a value of US$4.2 billion), many specialists are of the opinion that, because of lower yields in organic farming and the high prices of such products, organic farming cannot be treated as a generally practicable solution for food production problems.

Last, it can be mentioned that a new perspective is open because of the progress of molecular biology and the development of genetically modified organisms (GMO). Hopefully, the growing of new, pest-resistant plants will exclude or drastically reduce the use of insecticides and herbicides.

## 3. Good Veterinary Practice. A Tool for Improvement in Food Safety

To achieve optimal productivity and profitability, modern animal husbandry is trying to achieve the fastest growth of animals and the best conversion efficiency to produce milk, meat, and eggs at the lowest cost. In addition, an important factor of the effectiveness of animal husbandry is the reduction of losses caused by disease and the death of animals. The aims mentioned above resulted in veterinary drugs that are widely used in modern animal husbandry. Although their use contributed to more effective food production, food supply residues of some drugs and chemicals pose a health risk for humans. Among the potential contaminants of foods of animal origin (e.g., meat, milk, and eggs), the use of hormones and antibiotics is a focus of interest.

The problems connected with the potential growth of antimicrobial resistant microorganisms as a consequence of the wide use of antibiotics in modern animal

husbandry, stimulates efforts to find alternative solutions. The public has become increasingly alarmed by the emergence and spread of antibiotic-resistant bacteria. It is true that microbial resistance to antibiotics is on the rise.

For bacteria to develop resistance to antibiotics, they must first receive exposure to them. The source of this is, however, disputed by scientists. Primarily, the overuse of prescribed drugs in human and veterinary medicine have been banned. It is now an accepted rule that antibiotics used in human therapy should not be used in animal husbandry. Reducing or banning their use is a way to improve food safety.

Similar to plant protection, good veterinary practice is an important part of safety improvement. There are efforts to search for natural alternatives to antimicrobials, and for efficient regulations at national and international levels (see *Quality Control of Animal Development, Animal Protection, and Quarantine*)**.** Among the alternatives to antibiotics, organic acids, extra enzymes, and extracts of herbs and spices are recommended.

## 4. Good Manufacturing Practice Contributes to Food Safety

The aim of the special set of recommendations (in many countries also regulations) called Good Manufacturing Practice (see *Food Manufacturing Practices and Sanitation*) is the minimization of risks of contamination in the entire process of food production. Among potential risks, microbiological and chemical contamination should be mentioned. Production facilities should be designed to prevent contamination.

The plant should be surrounded by properly drained grass and foliage, as a first line protection against contamination. Access to the building by persons, animals, insects, and objects should be strictly controlled. Production and storage areas should have smooth, nonporous, and easily cleanable walls, floors, and ceilings. All equipment surfaces should be made of materials that are not reactive, absorptive, or additive. Glass, stainless steel, and teflon are frequently recommended.

From the point of view of the prevention of microbiological contamination, the modern approach to GMP is based on a systematic study of all possible hazards in industrial food production. This approach is known as Hazard Analysis and Critical Control Point (HACCP), and it has received international recognition (see *Food Manufacturing Practice and Sanitation*).

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## Biographical Sketches

**Radomir Lásztity**, D.Sc., Professor of the Department of Biochemistry and Food Technology at Budapest University of Technology and Economics, was born 1929 in Deszk, Hungary, and ended his studies in 1951 at the Faculty of Chemical Engineering of the Technical University of Budapest. Dr. Lásztity received his M.Sc. degree in Chemical Engineering in 1951 and his D.Sc. degree in Chemical Science in 1968.

Dr. Lásztity is honorary president of ICC (International Association for Cereal Science and Technology). He was Chairman of the Codex Committee on Methods of Analysis and Sampling of the FAO/WHO Food Standard Program in the period 1975–1988. Dr. Lásztity is a member of the Food Division of the Federation of European Chemical Societies and a member of the editorial boards of several international scientific journals. He was Vice-Rector of the Technical University from 1970 to 1976.

Among other awards he has received the Bailey and Schweitzer Medal of the ICC, the State Prize of the Hungarian Republic, and the Golden Medal of the Czech Academy of Sciences.

Dr. Lásztity's main research activities are chemistry and biochemistry of food proteins, food analysis, and food control. The results of his research work were published in more than 700 papers in foreign and Hungarian journals. He is the author of more than 20 books and textbooks (among them: *Chemistry of Cereal Proteins*, First and Second Editions in 1984 and 1996, respectively; *Amino Acid Composition and Biological Value of Cereal Proteins*, 1985; *Use of Yeast Biomass in Food Production*, 1991; *Gluten Proteins*, 1987; and *Cereal Chemistry*, 1999).

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She received her M.Sc. Degree from Budapest University of Technology and Economics (faculty of Chemical Engineering) in 1961 and her D.Sc. degree in 1968 from The Hungarian Academy of Sciences.

Dr. Halász is Chairman of the section of Food and Agriculture of the Hungarian Biochemical Society, a member of the Working group on Microbiology of the Hungarian Scientific Society for Food Industry, and a member of the Yeast Working Group of the International Association for Cereal Science and Technology.

She has been the recipient of the Distinguished Researchers Award of the Ministry of Agriculture, and she was awarded the Bronze Medal of the Hungarian Republic. She is also a recipient of the Swiss Federal Foundation Fellowship in science (1970, 1971).

Dr. Halász has presented more than 100 invited lectures at international and national scientific meetings, universities, and other institutions. She has published more than 100 research papers. Her major interest is food microbiology and food safety.