
**MICRO-
ORGANISMS
IN FOODS**

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MICRO- ORGANISMS IN FOODS



MICROBIAL ECOLOGY OF FOOD COMMODITIES

SECOND EDITION

ICMSF

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Preface

The second edition of *Microbiology of Foods 6: Microbial Ecology of Food Commodities* was written by the ICMSF, comprising 16 scientists from 11 countries, plus consultants and other contributors to chapters.

The intention of the second edition was to bring the first edition (published in 1996) up to date, taking into account developments in food processing and packaging, new products, and recognition of new pathogens and their control acquired since the first edition.

The overall structure of the chapters has been retained, viz each covers (i) the important properties of the food commodity that affect its microbial content and ecology, (ii) the initial microflora at slaughter or harvest, (iii) the effects of harvesting, transportation, processing, and storage on the microbial content, and (iv) an assessment of the hazards and risks of the food commodities and (v) the processes applied to control the microbial load.

In 1980s, control of food safety was largely by inspection and compliance with hygiene regulations, together with end-product testing. *Microorganisms in Foods 2: Sampling for Microbiological Analysis: Principles and Specific Applications (2nd ed. 1986)* put such testing on a sounder statistical basis through sampling plans, which remain useful when there is no information on the conditions under which a food has been produced or processed, e.g. at port-of-entry. At an early stage, the Commission recognized that no sampling plan can ensure the absence of a pathogen in food. Testing foods at ports of entry, or elsewhere in the food chain, cannot guarantee food safety.

This led the Commission to explore the potential value of HACCP for enhancing food safety, particularly in developing countries. *Microorganisms in Foods 4: Application of the Hazard Analysis Critical Control Point (HACCP) System to Ensure Microbiological Safety and Quality (1988)* illustrated the procedures used to identify the microbiological hazards in a practice or a process, to identify the critical control points at which those hazards could be controlled, and to establish systems by which the effectiveness of control could be monitored. Recommendations are given for the application of HACCP from production/harvest to consumption, together with examples of how HACCP can be applied at each step in the food chain.

Effective implementation of HACCP requires knowledge of the hazardous microorganisms and their response to conditions in foods (e.g. pH, a_w , temperature, preservatives). The Commission concluded that such information was not collected together in a form that could be assessed easily by food industry personnel in quality assurance, technical support, research and development, and by those in food inspection at local, state, regional or national levels. *Microorganisms in Foods 5: Characteristics of Microbial Pathogens (1996)* is a thorough, but concise, review of the literature on growth, survival, and death responses of foodborne pathogens. It is intended as a quick reference manual to assist making judgements on the growth, survival, or death of pathogens in support of HACCP plans and to improve food safety.

The second edition of *Microorganisms in Foods 6: Microbial Ecology of Food Commodities (2004)* is intended for those primarily in applied aspects of food microbiology. For 17 commodity areas, it describes the initial microbial flora and the prevalence of pathogens, the microbiological consequences of processing, typical spoilage patterns, episodes implicating those commodities with foodborne illness, and measures to control pathogens and limit spoilage. Those control measures are presented in a standardized format, and a comprehensive index has been added.

The second edition of *Microorganisms in Foods 6: Microbial Ecology of Food Commodities* has been written following *Microorganisms in Foods 7: Microbiological Testing in Food Safety Management* (2002). The latter illustrates how systems such as HACCP and GHP provide greater assurance of safety than microbiological testing, but also identifies circumstances where microbiological testing still plays a useful role in systems to manage food safety. It continues to address the Commission's objectives to: (a) assemble, correlate, and evaluate evidence about the microbiological safety and quality of foods; (b) consider whether microbiological criteria would improve and assure the microbiological safety of particular foods; (c) propose, where appropriate, such criteria; (d) recommend methods of sampling and examination; (e) give guidance on appraising and controlling the microbiological safety of foods. It introduces the reader to a structured approach for managing food safety, including sampling and microbiological testing. The text outlines how to meet specific food safety goals for a food or process using Good Hygienic Practice (GHP) and the HACCP system. Control measures as used in GHP and HACCP are structured into three categories: those that influence the initial level of the hazard, those that cause reduction, and those that may prevent increase, i.e. during processing and storage. In *Microorganisms in Foods 6*, a control section following each commodity group uses this structured approach.

Microorganisms in Foods 5, 7, and the second edition of *Microorganisms in Foods 6* (2005) are intended for anyone using microbiological testing and/or engaged in setting Microbiological Criteria, whether for the purpose of Governmental Food Inspection and Control or in Industry. The contents are essential reading for food processors, food microbiologists, food technologists, veterinarians, public health workers and regulatory officials. For students in Food Science and Technology, they offer a wealth of information on Food Microbiology and Food Safety Management, with many references for further study.

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