
Fermentation and Food Safety

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Foreword

In every part of the world, people wage a constant battle against food contamination and the resulting food-borne diseases and food wastage. Efforts to reduce the devastating consequences of food contamination started long before written records. Besides cooking, smoking, and simple sun drying, fermentation is one of the oldest technologies used for food preservation. Over the centuries, it has evolved and has been refined and diversified. Today, a large variety of foods are derived from this technology, which is used in households, small-scale food industries, and large-scale enterprises. Foods so produced form a major part of the human diet all over the world but only a few people are aware of the multitude of fermented products and their importance in the human diet. In fact, all cultures have in the course of their development learned the technique to preserve some of their foods by fermentation. However, the safety of fermented foods is a concern everywhere.

In the past, traditional fermentation technologies were based on experiences accumulated by consecutive generations of food producers, as a result of trial and error. Only relatively recently have science and technology started to contribute to a better understanding of the underlying principles of the fermentation process and of the essential requirements to ensure the safety as well as nutritional and sensory quality of fermented foods. Since the days of Louis Pasteur, who pointed to the importance of hygiene in relation to fermentation, it is known that this technology is easily influenced by various factors

during processing, and if not applied correctly, the safety and/or quality of the final product may be jeopardized. As a matter of fact, causes and outbreaks of food-borne illness have been traced back to fermented food, in spite of the general ineffectiveness of food-borne disease surveillance programs in most countries.

Fermentation is also of economic importance in areas or for populations where preservation technologies such as cold storage (refrigeration) or hot-holding cannot be used for lack of resources or facilities. In such situations, fermentation may be considered an affordable technology, which—if applied correctly—results in the safe preservation of foods, including complementary foods for infants. Particularly in developing countries, as a result of poor hygiene and incorrect application of fermentation, complementary foods are often contaminated with pathogens and subsequently are a major cause of infant diarrhea and associated malnutrition.

Against this background, the World Health Organization (WHO), jointly with the Food and Agriculture Organization (FAO), organized in 1995 a workshop to assess fermentation as a household technology for improving food safety.¹ This workshop was the first of its kind, highlighting the critical points in the fermenta-

¹Fermentation: Assessment and Research. Report of a Joint FAO/WHO Workshop, Pretoria, South Africa, 11–15 December 1995. WHO Consultations and Workshops: WHO/FNU/FOS/96.1

tion process to ensure the safety of the resulting products, in line with the Hazard Analysis and Critical Control Point (HACCP) system. In a way, this book is a result of this workshop. Both Aspen Publishers and the two editors, M.J. Robert Nout and Martin R. Adams, deserve applause for this initiative and the unique approach they have adopted: the book focuses on food safety in all its aspects and is largely hazard based, which helps to identify those areas where knowledge is lacking but needed for a satisfactory risk assessment to be made. This is in contrast to the existing literature on fermented foods, which is generally confined to descriptions of the product(s)

and the microbiology/biochemistry of their production.

In the interest of public health and food security, I wish this book a large and interested readership and for fermentation to result in safe, nutritionally adequate, and superbly tasting foods with long shelf lives.

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Preface

Fermented foods enjoy worldwide popularity as attractive, wholesome and nutritious components of our diet. They are produced on an enormous scale employing a huge variety of ingredients and manufacturing techniques. Whether traditional home-made foods, or high-tech products derived from genetically modified organisms, the safety of the consumer remains of foremost importance.

Fermented foods have always been generally regarded as safe, but this reputation has been seriously threatened in recent years by incidents such as outbreaks of illness caused by pathogens in soft cheeses and fermented meats, chronic cyanide intoxications from poorly processed cassava tubers, and mycotoxins in fermented cereal foods. In addition, modern techniques of genetic engineering and biotechnology, which offer considerable opportunities in the area of fermented food production, have also raised safety concerns among consumers. It is necessary therefore to have concrete guidelines on the conditions which lead to safe products and to have a realistic view about what "guaranteed safety" means. The massive impact of HACCP as a systematic approach to ensuring food safety has been widely apparent in recent years and the technique is as applicable to food fermentation as to any other food processing operation. At present however, the literature on fermented foods has no focus on safety, but is mainly descriptive, concentrating on microorganisms responsible for fermentation and on the biochemical changes occurring in the food.

This book aims to integrate modern concepts of safety assurance with the sometimes very traditional environment of the production and distribution of fermented foods. In particular, we have taken a largely hazard-based approach rather than one centered on the different commodities used. Introductory chapters aim to provide a broad understanding of the nature of fermented foods, their production, distribution, and use by consumers, and also discuss the general features of fermentation processes that contribute to the product's overall safety and HACCP. For the bulk of the book, we have sought chapters which describe the principal individual hazards, both chemical and microbiological, and try to provide some guidance on how these might be controlled in food fermentations. These hazards are discussed from the point of view of their severity and incidence, how they get into the food, which foods are specifically at risk, and what, if any, are the conditions that remove or inactivate these hazards. In many cases there is a dearth of published material specifically on fermented foods, and contributors have used data obtained in slightly different contexts to give some guidance. This exercise has proved useful in highlighting where information is lacking and identifying areas where more research is desperately needed.

It is hoped that the book will serve as a source of reference to support and help improve the production of safe fermented foods at all scales (household preparation up to large-scale industrial plants) and using all major food groups.