Contents

List of Contributors, xvii
Preface, xxi

Part I Meat Fermentation Worldwide: Overview, Production, and Principles, 1

1 Dry-Fermented Sausages and Ripened Meats: An Overview, 3
Fidel Toldrá and Y.H. Hui
1.1 Introduction, 3
1.2 Fermented sausages and ripened meats around the world, 3
1.3 The importance of fermented sausages, 5
Acknowledgement, 6
References, 6

2 Production and Consumption of Fermented Meat Products, 7
Herbert W. Ockerman and Lopa Basu
2.1 Introduction, 7
2.2 Current products, 7
2.3 The Future, 10
References, 10

3 Principles of Meat Fermentation, 13
Eero Puolanne and Esko Petäjä-Kanninen
3.1 Introduction, 13
3.2 Fermentation, 14
3.3 Factors influencing fermentation, 15
3.4 Proteolysis, 15
3.5 Lipolysis, 15
3.6 Antagonistic effects, 16
References, 16

4 Principles of Curing, 19
Ronald B. Pegg and Karl O. Honikel
4.1 Definition of curing, 19
4.2 History of curing, 19
4.3 Legislation, 20
4.4 Chemistry of nitrite and nitrate, 20
4.5 Nitrite and nitrate in meat products, 22
4.6 Nitrosomyoglobin (NOMb), 27
4.7 N-nitrosamine formation, 28
4.8 Conclusion, 29
References, 29

5 Principles of Drying, 31
Raúl Grau, Ana Andres, and José M. Barat
5.1 Introduction, 31
5.2 Basic principles of drying, 31
5.3 Hurdle technology applied to dried meat and poultry products, 32
5.4 Fundamentals of the drying of meat and poultry products, 34
5.5 Drying kinetics modeling, 35
5.6 Air conditioning and circulation in meat drying, 35
References, 36

6 Principles of Smoking, 39
Zdzisław E. Sikorski and Izabela Sinkiewicz
6.1 Introduction, 39
6.2 Wood-smoke composition, 39
6.3 The preserving effect, 40
6.4 The flavoring effect, 41
6.5 Benefits and risks, 42
6.6 Food engineering approach, 43
6.7 Smoking procedures, 45
References, 45

Part II Raw Materials, 47

7 The Biochemistry of Meat and Fat, 49
Fidel Toldrá and Milagro Reig
7.1 Introduction: muscle structure, 49
7.2 Meat composition, 49
7.3 Muscle proteases and lipases, 51
7.4 Adipose tissue lipases, 52
7.5 Post mortem muscle metabolism and quality, 53
References, 53

8 Ingredients, 55
Jorge Ruiz and Trinidad Pérez-Palacios
8.1 Introduction, 55
8.2 Lean, 55
8.3 Fat, 56
8.4 Factors affecting the suitability of lean and fat for processing, 56
8.5 Other ingredients, 62
References, 65

9 Additives, 69
Pedro Roncalés
9.1 Introduction, 69
9.2 Acids and related additives, 69
9.3 Antioxidants, 70
9.4 Colorants, 70
9.5 Emulsifiers, 71
9.6 Flavor enhancers, 72
9.7 Flavoring agents, 73
9.8 Preservatives, 74
9.9 Multipurpose additives: phosphates, 75
References, 76

10 Spices and Seasonings, 79
Suey Ping Chi and Yun Chu Wu
10.1 Introduction, 79
10.2 Ethnic preferences, 79
10.3 Commonly used spices in processed meats, 80
10.4 Botanical properties, 80
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Product forms and appearances</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>Chemical properties</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>Quality standards</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>10</td>
<td>Sensory properties</td>
<td></td>
<td>82</td>
</tr>
<tr>
<td>10</td>
<td>Applications in fermented meat processing</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>10</td>
<td>Conclusion</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>11</td>
<td>Casings</td>
<td>Yun Chu Wu, Suey Ping Chi, and Souad Christieans</td>
<td>89</td>
</tr>
<tr>
<td>11</td>
<td>Introduction</td>
<td></td>
<td>89</td>
</tr>
<tr>
<td>11</td>
<td>Natural casings</td>
<td></td>
<td>89</td>
</tr>
<tr>
<td>11</td>
<td>Artificial casings</td>
<td></td>
<td>93</td>
</tr>
<tr>
<td>11</td>
<td>Regulatory compliance</td>
<td></td>
<td>94</td>
</tr>
<tr>
<td>11</td>
<td>Handling casings</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>11</td>
<td>Quality determination</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>11</td>
<td>Conclusion</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
<td>96</td>
</tr>
<tr>
<td><strong>Part III Microbiology and Starter Cultures</strong></td>
<td></td>
<td></td>
<td>97</td>
</tr>
<tr>
<td>12</td>
<td>Microorganisms in Traditional Fermented Meats</td>
<td>Sabine Leroy, Isabelle Lebert, and Régine Talon</td>
<td>99</td>
</tr>
<tr>
<td>12</td>
<td>Introduction</td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>12</td>
<td>Traditional sausage manufacture</td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>12</td>
<td>Description of ecosystems</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>12</td>
<td>Identification of technological microbiota</td>
<td></td>
<td>102</td>
</tr>
<tr>
<td>12</td>
<td>Conclusion</td>
<td></td>
<td>103</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
<td>103</td>
</tr>
<tr>
<td>13</td>
<td>The Microbiology of Fermentation and Ripening</td>
<td>Margarita Garriga and Teresa Aymerich</td>
<td>107</td>
</tr>
<tr>
<td>13</td>
<td>Introduction</td>
<td></td>
<td>107</td>
</tr>
<tr>
<td>13</td>
<td>The manufacture of fermented sausages</td>
<td></td>
<td>107</td>
</tr>
<tr>
<td>13</td>
<td>Technological microflora</td>
<td></td>
<td>108</td>
</tr>
<tr>
<td>13</td>
<td>Spoilage microflora</td>
<td></td>
<td>111</td>
</tr>
<tr>
<td>13</td>
<td>Foodborne pathogens</td>
<td></td>
<td>111</td>
</tr>
<tr>
<td>13</td>
<td>Starter cultures</td>
<td></td>
<td>111</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
<td>112</td>
</tr>
<tr>
<td>14</td>
<td>Bacteria</td>
<td>Pier Sandro Cocconcelli and Cecilia Fontana</td>
<td>117</td>
</tr>
<tr>
<td>14</td>
<td>Introduction</td>
<td></td>
<td>117</td>
</tr>
<tr>
<td>14</td>
<td>Bacterial starter cultures used for fermented meats</td>
<td></td>
<td>117</td>
</tr>
<tr>
<td>14</td>
<td>Starter cultures: technological advantage in the meat environment</td>
<td></td>
<td>120</td>
</tr>
<tr>
<td>14</td>
<td>Safety of selected meat starter-culture bacteria</td>
<td></td>
<td>123</td>
</tr>
<tr>
<td>14</td>
<td>Conclusion</td>
<td></td>
<td>124</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td></td>
<td></td>
<td>124</td>
</tr>
<tr>
<td>15</td>
<td>Bioprotective Cultures</td>
<td>Graciela Vignolo, Patricia Castellano, and Silvina Fadda</td>
<td>129</td>
</tr>
<tr>
<td>15</td>
<td>Introduction</td>
<td></td>
<td>129</td>
</tr>
<tr>
<td>15</td>
<td>Starter cultures for meat fermentation</td>
<td></td>
<td>129</td>
</tr>
<tr>
<td>15</td>
<td>Competitiveness of starter cultures</td>
<td></td>
<td>131</td>
</tr>
</tbody>
</table>

**Contents vii**
Contents

15.4 Bioprotective cultures for fermented meat products, 132
15.5 Conclusion, 135
   References, 135

16 Yeasts, 139
   M.D. Selgas and M.L. Garcia
   16.1 Introduction, 139
   16.2 Presence of yeasts on meat sausages, 139
   16.3 Role of yeasts in meat products, 140
   16.4 Yeast starter cultures, 144
       References, 144

17 Molds, 147
   Elettra Berni
   17.1 Introduction, 147
   17.2 Fungal contamination in ripening environments, 147
   17.3 Fungal starter cultures, 148
   17.4 Lipolytic and proteolytic activity of starter cultures, 149
   17.5 Growth and competitiveness of starter cultures, 149
   17.6 Conclusion, 151
       References, 151

18 Probiotics, 155
   Keizo Arihara
   18.1 Introduction, 155
   18.2 Probiotics and probiotic foods, 155
   18.3 Probiotics and meat products, 156
   18.4 Prebiotics and synbiotics, 157
   18.5 Conclusion, 158
       References, 158

19 The Genetics of Microbial Starters, 161
   Jamila Anba-Mondoloni, Marie-Christine Champomier-Vergès, Monique Zagorec, Sabine Leroy,
   Emilie Dordet-Frisoni, Stella Planchon, and Régine Talon
   19.1 Introduction, 161
   19.2 Chromosome elements, 161
   19.3 Plasmids, 163
   19.4 DNA transfer and genetic tools, 163
   19.5 Post-genomics studies, 164
       References, 165

20 The Influence of Processing Parameters on Starter Culture Performance, 169
   F. Leroy, T. Goudman and L. De Vuyst
   20.1 Introduction, 169
   20.2 Influence of raw materials, 169
   20.3 Influence of temperature, 170
   20.4 Influence of added fermentable carbohydrates, 171
   20.5 Influence of salting and drying, 172
   20.6 Influence of curing agents, 173
   20.7 Influence of spices, 173
   20.8 Influence of sausage caliber, 173
   20.9 Influence of maturation and molding, 173
   20.10 Conclusion, 174
       Acknowledgments, 174
       References, 174
21 Methodologies for the Study of Microbial Ecology in Fermented Sausages, 177
Valentina Alessandria, Kalliopi Rantsiou, Paola Dolci, and Luca Cocolin

21.1 Introduction, 177
21.2 Molecular approaches to the study of microbial ecology in fermented sausages, 178
21.3 Culture-independent methods, 178
21.4 Definition of the microbial ecology in fermented sausages by culture-independent methods, 180
21.5 Culture-dependent methods, 182
21.6 Definition of the microbial ecology in fermented sausages by culture-dependent methods, 183
21.7 Conclusion, 184
References, 185

Part IV Sensory Attributes, 189

22 Sensory Analyses-General Considerations, 191
Asgeir Nilsen, Marit Rødbotten, Ken Prusa, and Chris Fedler

22.1 Introduction, 191
22.2 Sensory methods, 191
22.3 Sensory analysis of fermented meat products, 192
References, 194

23 Color, 195
Jens K.S. Møller, Sisse Jongberg, and Leif H. Skibsted

23.1 Introduction, 195
23.2 Color-forming compounds, 195
23.3 Chemistry of meat color, 195
23.4 Influence of fermentation parameters on color, 197
23.5 Bacterial role in meat color, 199
23.6 Natural and organic cured meat, 200
23.7 Color stability of cured meat products, 201
23.8 Conclusion, 203
Acknowledgment, 203
References, 203

24 Texture, 207
Shai Barbut

24.1 Introduction, 207
24.2 Texture of commercial products, 207
24.3 Texture development during fermentation, 207
24.4 Texture development during ripening, 210
24.5 Texture development during cooking (nondried/semdried), 211
24.6 Effects of processing parameters, 213
24.7 Effects of product modification with non-meat ingredients, 214
24.8 Conclusion, 214
References, 215

25 Flavor, 217
Mónica Flores and Alicia Olivares

25.1 Introduction, 217
25.2 Precursor generation reactions of fermented meat flavor, 217
25.3 Volatile compound generation reactions, 218
25.4 Extraction and identification of volatile compounds, 218
Contents

25.5 Elucidation of aroma active compounds, 220
25.6 Relevance of volatile compounds in fermented meats, 220
    References, 224

Part V  Product Categories: General Considerations, 227

26 Composition and Nutrition, 229
    Daniel Demeyer
    26.1 Introduction, 229
    26.2 Nutrient supply from meat and meat products, 229
    26.3 Meat and meat products in healthy nutrition, 232
    26.4 Recommended meat intakes, 233
    26.5 Effects of fermentation on the nutritional and health properties of meat, 234
    References, 236

27 Functional Dry-Fermented Sausages, 241
    Diana Ansorena and Iciar Astiasarán
    27.1 Introduction, 241
    27.2 Modification of the mineral content in dry-fermented sausages, 241
    27.3 Fat modifications in dry-fermented sausages, 243
    27.4 Incorporation of fiber into dry-fermented sausages, 245
    27.5 Use of dry-fermented sausages as probiotics, 246
    27.6 Incorporation of vitamins, 246
    27.7 Conclusion, 247
    References, 247

28 Low-Sodium Products, 251
    Fidel Toldrá and José M. Barat
    28.1 Introduction, 251
    28.2 Relevance of salt in fermented meats, 251
    28.3 Strategies for sodium reduction, 252
    28.4 Effects of sodium reduction on quality and safety, 253
    References, 254

29 International Standards: United States, 259
    Elizabeth Boyle and Melvin C. Hunt
    29.1 Introduction, 259
    29.2 US regulatory process, 259
    29.3 Regulatory definitions and specifications, 260
    29.4 HACCP options, 261
    29.5 Validation, 261
    References, 261

30 International Standards: Europe, 263
    Reinhard Fries
    30.1 Introduction, 263
    30.2 Quality, 263
    30.3 Microbiological safeguarding in food chains, 266
    30.4 Generating microbiological data in practice, 268
    30.5 Microbiological criteria for foodstuffs in Reg. (EC) 2073/2005, 270
    References, 270

31 Packaging and Storage, 273
    Byungrok Min and Dong Uk Ahn
    31.1 Introduction, 273
31.2 Functions of food packaging, 273
31.3 Packaging materials, 274
31.4 Packaging systems, 276
31.5 Storage, 279
References, 279

Part VI Semidry-Fermented Sausages, 281
32 US Products-Semidry Sausage, 283
Robert E. Rust
32.1 Introduction, 283
32.2 Methods of acidification, 283
32.3 Food safety, 283
32.4 Manufacturing processes, 284
32.5 Different types of US semidry sausage, 285
Reference, 285
33 European Products, 287
Friedrich-Karl Lücke
33.1 Introduction, 287
33.2 Definition of “semidry-fermented sausage” in Europe, 287
33.3 General remarks on the manufacture of European-style semidry-fermented sausages, 288
33.4 Types of European-style semidry-fermented sausage, 290
33.5 Safety and stability, 291
33.6 Conclusion, 291
References, 291

Part VII Dry-Fermented Sausages, 293
34 US Products-Dry Sausage, 295
Robert Maddock
34.1 Introduction, 295
34.2 European versus US products, 295
34.3 Definitions, 295
34.4 US manufacturing processes for dried sausages, 296
34.5 Basic formulations and processes for selected large-diameter dried sausages, 297
34.6 Safe production of dried sausages in the United States, 298
34.7 Process control points for dried sausage manufacturing, 298
References, 299
35 Mediterranean Products, 301
Eva Hierro, Manuela Fernández, Lorenzo de la Hoz, and Juan A. Ordóñez
35.1 Introduction, 301
35.2 Production of Mediterranean dry-fermented sausages, 301
35.3 Changes during ripening of Mediterranean dry-fermented sausages, 303
35.4 Innovation in Mediterranean dry-fermented sausages, 306
35.5 Conclusion, 308
References, 309
36 Northern European Products, 313
Askild Holck, Even Heir, Tom C. Johannessen, and Lars Axelsson
36.1 Introduction, 313
36.2 Characteristics of Northern European sausages, 313
36.3 Sausages of Central Europe, 316
36.4 Sausages of Eastern Europe, 317
36.5 Sausages of the Nordic countries, 318
References, 320

37 Asian Products, 321
Ming-Ju Chen, Rung-Jen Tu, and Sheng-Yao Wang
37.1 Introduction, 321
37.2 Chinese products, 321
37.3 South East Asian products, 324
37.4 Himalayan fermented meat products, 326
References, 326

Part VIII Fermented Products from Poultry and Other Meats, 329
38 Fermented Poultry Sausages, 331
E. Arnaud, S.J. Santchurn, and A. Collignan
38.1 Introduction, 331
38.2 Fermented poultry sausages, 332
38.3 Other fermented products, 336
References, 336

39 Fermented Sausages from Other Meats, 339
Emin Burçin Özvural and Halil Vural
39.1 Introduction, 339
39.2 Fermented products from other meats, 339
39.3 Scientific studies on other meats, 340
References, 342

Part IX Ripened Meat Products, 345
40 US Products-Dry-Cured Hams, 347
Dana J. Hanson, Gregg Rentfrow, M. Wes Schilling, W. Benjy Mikel, Kenneth J. Stalder, and Nicholas L. Berry
40.1 Introduction, 347
40.2 Country ham standards, 347
40.3 Commercial dry-cured ham production in the United States, 348
40.4 Ham curing at home, 351
40.5 Safety, 352
40.6 Cooking, 352
40.7 Research, 352
References, 353

41 Central and South American Products, 355
Silvina Fadda and Graciela Vignolo
41.1 Introduction, 355
41.2 Meat consumption and habits, 355
41.3 Meat production in Latin American countries, 355
41.4 Typical meat products, microbial ecology, and safety risks, 356
41.5 Conclusion, 359
References, 359

42 Mediterranean Products, 361
Mario Estévez, Sonia Ventanas, David Morcuende, and Jesús Ventanas
42.1 Introduction, 361
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.2 Production of dry-cured hams</td>
<td>361</td>
</tr>
<tr>
<td>42.3 Spanish dry-cured hams</td>
<td>362</td>
</tr>
<tr>
<td>42.4 Italian dry-cured hams</td>
<td>365</td>
</tr>
<tr>
<td>42.5 French dry-cured hams</td>
<td>367</td>
</tr>
<tr>
<td>References</td>
<td>368</td>
</tr>
<tr>
<td>43 Nordic Products</td>
<td>371</td>
</tr>
<tr>
<td>Torunn Thauland Håseth, Gudjon Thorkelsson, Eero Puolanne, and Maan Singh Sidhu</td>
<td></td>
</tr>
<tr>
<td>43.1 Introduction</td>
<td>371</td>
</tr>
<tr>
<td>43.2 Norwegian fenalår</td>
<td>371</td>
</tr>
<tr>
<td>43.3 Norwegian pinnekjøtt</td>
<td>372</td>
</tr>
<tr>
<td>43.4 Norwegian dry-cured ham (spekeskinke)</td>
<td>373</td>
</tr>
<tr>
<td>43.5 Icelandic hangikjöt</td>
<td>373</td>
</tr>
<tr>
<td>43.6 Faroese skerpikjøt</td>
<td>373</td>
</tr>
<tr>
<td>43.7 Greenlandic mattaq and igunaq</td>
<td>374</td>
</tr>
<tr>
<td>43.8 Finnish Lapin Poron kylmäsavuliha</td>
<td>374</td>
</tr>
<tr>
<td>43.9 Finnish Lapin Poron kuivaliha</td>
<td>375</td>
</tr>
<tr>
<td>References</td>
<td>375</td>
</tr>
<tr>
<td>44 Asian Products</td>
<td>377</td>
</tr>
<tr>
<td>Guang-Hong Zhou and Gai-Ming Zhao</td>
<td></td>
</tr>
<tr>
<td>44.1 Introduction</td>
<td>377</td>
</tr>
<tr>
<td>44.2 History and traits of Jinhua ham</td>
<td>377</td>
</tr>
<tr>
<td>44.3 Processing of Jinhua ham</td>
<td>377</td>
</tr>
<tr>
<td>44.4 Possible factors causing differences in Chinese dry-cured hams</td>
<td>380</td>
</tr>
<tr>
<td>References</td>
<td>381</td>
</tr>
<tr>
<td>Part X Biological and Chemical Safety of Fermented Meat Products</td>
<td>383</td>
</tr>
<tr>
<td>45 Spoilage Microorganisms: Risks and Control</td>
<td>385</td>
</tr>
<tr>
<td>Marie-Christine Champomier-Vergès and Monique Zagorec</td>
<td></td>
</tr>
<tr>
<td>45.1 Introduction</td>
<td>385</td>
</tr>
<tr>
<td>45.2 Putative spoilage microorganisms</td>
<td>385</td>
</tr>
<tr>
<td>45.3 Examples of spoilage occurring in fermented sausage</td>
<td>386</td>
</tr>
<tr>
<td>45.4 Strategies for spoilage control</td>
<td>386</td>
</tr>
<tr>
<td>45.5 Conclusion</td>
<td>387</td>
</tr>
<tr>
<td>References</td>
<td>388</td>
</tr>
<tr>
<td>46 Pathogens: Risks and Control</td>
<td>389</td>
</tr>
<tr>
<td>Panagiotis Skandamis and George-John E. Nychas</td>
<td></td>
</tr>
<tr>
<td>46.1 Introduction</td>
<td>389</td>
</tr>
<tr>
<td>46.2 Hazard identification</td>
<td>390</td>
</tr>
<tr>
<td>46.3 Hazard characterization: defense mechanism</td>
<td>390</td>
</tr>
<tr>
<td>46.4 Exposure assessment</td>
<td>392</td>
</tr>
<tr>
<td>46.5 Control measures</td>
<td>406</td>
</tr>
<tr>
<td>References</td>
<td>409</td>
</tr>
<tr>
<td>47 Biogenic Amines: Risks and Control</td>
<td>413</td>
</tr>
<tr>
<td>M. Carmen Vidal-Carou, M. Teresa Veciana-Nogués, M. Luz Latorre-Moratalla, and Sara Bover-Cid</td>
<td></td>
</tr>
<tr>
<td>47.1 Introduction: biogenic amine classification and relevance</td>
<td>413</td>
</tr>
<tr>
<td>47.2 Health risks of biogenic amines in fermented sausages</td>
<td>413</td>
</tr>
<tr>
<td>47.3 Aminogenesis in fermented sausages and measures for its control</td>
<td>415</td>
</tr>
<tr>
<td>47.4 Conclusion</td>
<td>424</td>
</tr>
<tr>
<td>References</td>
<td>424</td>
</tr>
</tbody>
</table>
48 Toxic Compounds of Chemical Origin, 429
Milagro Reig and Fidel Toldrás
48.1 Introduction, 429
48.2 N-nitrosamines, 429
48.3 Polycyclic aromatic hydrocarbons (PAHs), 430
48.4 Oxidation, 431
48.5 Veterinary drug residues, 431
48.6 Environmental contaminants, 433
References, 433
49 Foodborne Outbreaks, 435
Colin Pierre
49.1 Introduction, 435
49.2 Staphylococcus aureus, 435
49.3 Salmonella spp., 435
49.4 Verotoxigenic strains of Escherichia coli, 436
49.5 Yersinia enterocolitica, 437
49.6 Listeria monocytogenes, 437
49.7 Thermotolerant Campylobacter, 438
49.8 Parasites, 438
49.9 Conclusion, 438
References, 438

Part XI Processing Sanitation and Quality Assurance, 441
50 Basic Sanitation, 443
Beatriz Melero, Ana M. Diez, and Jordi Rovira
50.1 Introduction, 443
50.2 Raw materials and ingredients, 443
50.3 Plant environment, 443
50.4 Personnel hygiene and training, 446
References, 448
51 Processing Plant Sanitation, 451
Jordi Rovira, Ana M. Diez, and Beatriz Melero
51.1 Introduction, 451
51.2 Fermented meat products and poultry, 451
51.3 Fermented sausage processing plant sanitation, 452
51.4 Methods of evaluating the sanitation state of a plant, 457
51.5 Final considerations, 458
References, 458
52 Quality Control, 461
Fidel Toldrás, Mónica Flores, and M. Concepción Aristoy
52.1 Introduction, 461
52.2 Quality controls at each stage of processing, 461
52.3 Control of drying, 462
52.4 Control of sensory quality, 462
References, 466
53 HACCP: Hazard Analysis and Critical Control Points, 469
M.J. Fraqueza and A.S. Barreto
53.1 The HACCP concept: why use it, 469
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.2</td>
<td>HACCP model for fermented sausages: a generic model for HACCP implementation in traditional establishments and small fermented sausage plants, 470</td>
</tr>
<tr>
<td>53.3</td>
<td>Validation of the operative HACCP plan, 483</td>
</tr>
<tr>
<td>53.4</td>
<td>Revision of the HACCP plan, 483</td>
</tr>
<tr>
<td>53.5</td>
<td>Certification of food safety management systems, 484</td>
</tr>
<tr>
<td></td>
<td>References, 484</td>
</tr>
<tr>
<td>54</td>
<td>Quality Assurance Plan, 487</td>
</tr>
<tr>
<td>Friedrich-Karl Lücke</td>
<td></td>
</tr>
<tr>
<td>54.1</td>
<td>Introduction, 487</td>
</tr>
<tr>
<td>54.2</td>
<td>General remarks on the purchase and selection of raw materials, 487</td>
</tr>
<tr>
<td>54.3</td>
<td>Quality assurance plans and records for fermented sausages, 488</td>
</tr>
<tr>
<td>54.4</td>
<td>Quality assurance plans and records for raw dry hams, 490</td>
</tr>
<tr>
<td>54.5</td>
<td>Slicing, packaging, and storage of fermented sausages and raw dry hams, 492</td>
</tr>
<tr>
<td>54.6</td>
<td>End-product testing, 492</td>
</tr>
<tr>
<td>54.7</td>
<td>General remarks about the structure and extent of documentation, 493</td>
</tr>
<tr>
<td></td>
<td>References, 493</td>
</tr>
<tr>
<td></td>
<td>Index, 495</td>
</tr>
</tbody>
</table>