

Contents

Preface

vii

Section I: Usage of Probiotics in Food Products

1. Introduction to Probiotics

3

1. Introduction 3
2. Development of Probiotics 9
3. Concept of Probiotics 13
4. Safety Considerations in Probiotics 15
 - 4.1. Antimicrobial Resistance Profiles of 'Probiotics' 15
 - 4.2. Safety of Probiotics in Humans 16
5. Genetic Engineering 18
6. Validation of the Probiotic Concept 23
 - 6.1. Introduction 23
 - 6.2. Science of Probiotics: Development Episodes 24
 - 6.3. *Lactobacillus Reuteri*: An Obscure Species to a Probiotic Prototype 25
 - 6.4. Reuteri Physiology 26
 - 6.5. Probiotics: Fundamental Requirements 27
 - 6.6. Reuteri: An Efficacious and Safe Colonizer of Humans and Animals 28
 - 6.7. Reuteri Probiotics: Effect on Human Health 29
 - 6.8. Reuteri Containing Functional Foods: *Modus Operandi* to Humans 31
- Suggested Readings* 33

2. Generic Advantages in Health with Probiotics

1. Introduction 35
 - 1.1. Definition of Probiotics 36
 - 1.2. Characteristic Features of Probiotics 38
2. Generic Advantages in Health with Probiotics 40
 - 2.1. Human Health 41
 - 2.2. Plant Health 44
 - 2.3. Animal Health 45
3. Excellent Benevolence of Probiotics in Newer Food Products 47
 - 3.1. Dairy-Based Probiotic Foods 48
 - 3.1.1. Fresh Milk and Fermented Milk 49
 - 3.1.2. Yogurt (*Syn*: Yoghurt; Curd; Coagulated Milk; Bio-Yoghurt) 54

- 3.1.3. Cheese 57
- 3.1.4. Miscellaneous Dairy-Based Products 59
- 3.2. Non-Dairy Based Probiotic Food Products 60
 - 3.2.1. Organic Vegetable-Based Probiotic Food Products 60
 - 3.2.2. Fruit-Based Probiotic Products 63
 - 3.2.3. Cereal-Based Probiotic Food Products 64
 - 3.2.4. Meat-Based Probiotic Food Products 67
- 4. Splendid Efforts of Probiotics in Agricultural Domain 69
 - 4.1. Plants 69
 - 4.2. Animals 73
- 5. Fabulous Challenges in Probiotics Applications 77
 - 5.1. Viability and Survival of Probiotics 78
 - 5.2. Broad Sensory Acceptance 80
- 6. Futuristic Growth Profile of Probiotics 82
 - 6.1. Microencapsulation-Nanotechnology: Indulgence in Futuristic Probiotics 83
 - 6.2. Influence of Biotechnology on Probiotics 85
- 7. Stipulated Guidelines and Regulations for Probiotics 86
- 8. Summary and Conclusions 92
- Suggested Readings 93*

3. Probiotics as Nutritional Programmer for Goodness in Health and Longevity

94

- 1. Introduction 95
- 2. Role of Probiotics in Control and Management of Intestinal Microbiota (or Gut flora) 97
 - 2.1. Certain Consistently Proven Prebiotics 98
 - 2.2. Some Novel Prebiotics 101
- 3. Effectual Prebiotics throughout Individual's Life Span 103
 - 3.1. Prebiotics: Evaluation Techniques 103
 - 3.2. Prebiotics Effectiveness in Infants and Children 106
 - 3.3. Prebiotics Effectiveness in Adults 107
 - 3.4. Prebiotics Efficacy in Elder Humans 108
- 4. Prebiotics: The Excellent Therapeutic Agents 110
 - 4.1. Prebiotics: Therapeutic Advantages in Human Ailments 111
 - 4.2. Prospective Therapeutic Objectives 113
- 5. Futuristic Challenges and Goals 117
 - 5.1. Harmonization of Procedures Related to Ascertain Efficiency 118
 - 5.2. The Challenge of Personalization 119
- 6. Summary and Conclusions 120
- Suggested Readings 121*

4. Development of Functional Foods

122

- 1. Introduction 123
- 2. Development of Functional Foods 123
 - 2.1. Soy Isoflavon Based Functional Foods 123
 - 2.2. Microbial Generation of the Unsaturated Conjugated Linoleic and Linolenic Acids: Better Functional Foods for Tomorrow 125
 - 2.2.1. The Ruminant Production of Conjugated Linoleic Acid (LA) and Linolenic Acid (LNA) 131

- 2.2.2. Conjugated Linoleic Acid (CLA): The Recommended Human Intake 136
- 2.2.3. The Microbial CLA and CLNA Production 137
- 2.2.4. Alternative Substrate to CLA Production 138
- 2.2.5. Linoleic Acid Isomerase (LAI-Enzyme-Linoleate Isomerase) 139
- 2.2.6. Functional Food Variants and Probiotics 140
- 3. Conclusion 141
- Suggested Readings* 143

5. Milk-Based Probiotic Foods and Coronary Heart Disease (CHD) 144

- 1. Introduction 145
- 2. Probiotics 147
- 3. Probiotics and CHD: Mechanism of Action 150
- 4. Conclusions and Futuristic Trends 152
- Suggested Readings* 153

6. Probiotics in Specialized Dairy Fermented Food Products 154

- 1. Introduction 155
- 2. Fundamental Concepts of Probiotics 156
 - 2.1. Proper Selection of Probiotic Microorganisms 157
- 3. Advantageous Effects of Probiotics 160
- 4. Metabolic Capacity of Gut Bacteria 161
- 5. Applications of Probiotics Microorganisms in Dairy Foods (Food Products) 164
- 6. Probiotic Cheese Variants 166
- 7. Future Trends and Conclusive Remarks 173
- Suggested Readings* 174

Section II: Probiotics in Health

7. Probiotics and Reduction in Adult Lactose Tolerance 177

- 1. Introduction 177
 - 1.1. Age 178
 - 1.2. Genetic Background (Inheritance) 179
 - 1.3. Integrity of the Small Intestinal Membrane 179
 - 1.4. Small-Intestinal Transit Time 179
- 2. Colonic Metabolism (Via Fermentation) of Lactose 180
- 3. The Specific Clinical Symptoms of Lactose Intolerance 183
- 4. Significant Diagnostics of Lactose Intolerance 183
- 5. Usage of Pre- and Probiotics in Improving the Inherent Clinical Symptoms of Lactose Intolerance 185
 - 5.1. Hydrolysis of Lactose in Milk Products and Small Intestine 185
 - 5.2. Use of Probiotics to Manipulate Colonic Fermentation 186
 - 5.2.1. Removal of Lactose 187
 - 5.2.2. Removal of Glucose and Galactose
 - 5.2.3. Removal of Acetate-Butyrate-Lactate and Propionate
- Suggested Readings* 191

8. The Cereal-Based Functional Foods**193**

1. Introduction 193
 2. The Fermentation of Cereal Based Foods 194
 - 2.1. Certain Gainful Attributes of African Fermented Cereal-Based Foods/Food Products 195
 - 2.1.1. Extension of Shelf-Life and Improved Sensory-Nutritional Characteristics 196
 - 2.1.2. Inhibition of Pathogenic Microorganisms in Fermented Foods 196
 - 2.1.3. Production of Bacteriocins by Lactic Acid Bacteria 197
 - 2.1.4. Effect of Fermentation upon Toxic-Antinutritional-and-Indigestible Chemical Entities in Cereal Foods 199
 - 2.1.5. Reduction, Binding and Detoxification of Mycotoxins in Fermented Food Products 202
 3. Probiotic Ability and Potential in the Cereal-Based Beverages 206
 - 3.1. Boza 206
 - 3.2. Kvass 207
 - 3.3. Pozol 208
 4. The African Traditional Fermented Foods 208
 - 4.1. Ben-Saalga 210
 - 4.2. Dégué 211
 - 4.3. Kanun-Zaki 212
 - 4.4. Kenkey 212
 - 4.5. Koka 213
 - 4.6. Mageu (or Mahewu) 213
 - 4.7. Mawe 213
 - 4.8. Munkoyo 214
 - 4.9. Obushera (or Bushera) 215
 - 4.10. Ogi 216
 - 4.11. Poto Poto 217
 - 4.12. Thobwa 218
 - 4.13. Ting 218
 - 4.14. Uji 219
 5. The Indian Traditional Cereal Based Fermented Functional Foods 220
 - 5.1. Rice Based Products 222
 - 5.2. Wheat Based Fermented Foods 226
 6. Probiotic Cereal-Based Beverages 228
- Suggested Readings 237*

9. Functional Dairy Probiotic Foods Development: Trends, Concepts and Products**239**

1. Introduction 239
 2. Development of Functional Dairy Probiotic Foods and Trends 240
 3. Functional Dairy Probiotic Foods 247
 4. The Probiotic Food Products 248
- Suggested Readings 251*

10. Development of Innovative Dairy Products Using Probiotics: Challenges and Limitations**253**

1. Introduction 253
2. Requirements for a Probiotic in Innovative Foods: Challenges and Limitations 259
 - 2.1. Related Criteria for Determining Probiotics Efficacy
 - 2.2. Points to Ponder

- 2.3. Various Methods For Administration of *Reuteri* to Human *Reuteri*
Comprising Functional Foods
- 2.4. Important Features
- 2.5. Historical Introduction of '*Reuteri*' into the Human Functional Foods Market
- 2.6. Important Points
- 3. Conclusive Remarks
- Suggested Readings* 263

11. Milk and Dairy Products: Vectors to Make Improvised Probiotic Products 265

- 1. Introduction 265
- 2. Probiotics: Their Various Great Significant Characteristic Features 266
 - 2.1. Gainful Effects of Probiotics 266
 - 2.2. Important Applications of Probiotic Bacteria in Dairy Food Products 267
 - 2.3. Probiotic Cheese: Interesting Strong Potential to
Releasing Probiotic Microorganisms 269
- 3. Future Trends and Conclusive Remarks 276
- Suggested Readings* 279

12. Probiotic Confectionery Products 281

- 1. Introduction 281
- 2. Technological Features of Probiotics 284
- 3. Manufacturing Processes for the Fermented Probiotic Products 284
- 4. Probiotics: As Mono or Mixed Culture of Live Microorganisms Affecting
Characteristics of Indigeneous Microflora 289
- Suggested Readings* 291

13. Probiotic in Inflammatory Diseases 293

- 1. Introduction 293
- 2. Probiotics: Irritable Bowel Syndrome and Potential Target for Prevention
Treatment of Steatohepatitis 295
- 3. Inflammatory Bowel Disease (IBD) 296
- 4. Summary
- Suggested Readings* 299

14. Role of Probiotic in GUT Flora 301

- 1. Introduction 301
- 2. Immunoglobulin A(IgA) Representing the First Line of Defence in Mucosa 302
- 3. Probiotics and Irritable Bowel Syndrome (IBS) 304
- Suggested Readings* 305

15. Prevention of Necrotizing Process 307

- 1. Introduction 307
- 2. Polymeric Dressings 307
- 3. Various Important Necrotizing Profiles 310
 - 3.1. Clostridial Necrotizing Enteritis (CNE) 310
 - 3.2. Necrotizing Enterocolitis (NEC) (Neonatal) 311

- 3.3. Necrotizing Migrating Erythema 312
 - 3.3.1. Endocrine Paraneoplastic Syndromes 313
 - 3.3.2. GI-Paraneoplastic Syndromes 313
 - 3.3.3. Hematologic Paraneoplastic Syndromes 313
- 3.4. Necrotizing Subcutaneous Infection (Necrotizing Fasciitis) 314
- 3.5. Acute Necrotizing Ulcerative Gingivitis 314
- Suggested Reading* 316

Section III: Probiotics in Biotechnological Aspects

16. Probiotics Stabilization 318

- 1. Introduction 318
- 2. Probiotics Stabilization vs Technological Aspects of Probiotics 320
- 3. Important Requirements of Probiotic Conditionalities of Gut-Microflora 321
- 4. Probiotics: The Wonderful Living Drugs 324
 - 4.1. Evidence-Based Uses of Probiotics 325
 - 4.2. Prevention of the Traveler's Diarrhoea 328
 - 4.3. Prevention of Acute Infantile Diarrhoea 329
 - 4.4. Treatment of Acute Diarrhoea 329
 - 4.5. Vaginal Infections 330
 - 4.6. Urinary-Tract Infections 331
- Suggested Readings* 333

17. Probiotics: Types and Specifications 335

- 1. Introduction 335
- 2. Types of Probiotics 335
- 3. Specifications of Probiotics 338
- Suggested Readings* 339

Section IV: Probiotics in Aquaculture

18. Probiotics in Shrimp Larvae 343

- 1. Introduction 343
- 2. Probiotics 348
- 3. Perspectives and Conclusive Remarks 360
- Suggested Readings* 361

19. Probiotics in Biofilms 363

- 1. Introduction 363
- 2. Role of Biofilms at the Site-of-action of Various Pharmaceutical Alternatives 363
- 3. Influence of Iron and Lactoferrin Upon the Development of Biofilm by *Pseudomonas aeruginosa* and *Burkholderia cepacia* Isolated from Cystic Fibrosis Patients 365
- Suggested Reading* 366