

Table of Contents

Preface	1
I. HUMAN NUTRITION	3
1.1. Metabolism and Food Intake	4
1.1.1. Metabolism	4
1.1.2. Human Gastrointestinal Tract	6
1.1.2.1. Ingestion	6
1.1.2.2. The stomach	7
1.1.2.3. The liver	7
1.1.2.4. The pancreas	9
1.1.2.5. The small intestine	9
1.1.2.6. The large intestine	11
1.1.3. Metabolic Pathways	12
1.1.3.1. Glycolysis	13
1.1.3.2. Fatty Acids Oxidation (β oxidation)	14
1.1.3.3. Aerobic Respiration	16
1.1.3.4. Krebs's Cycle (Citric Acid Cycle)	16
1.1.3.5. Electron Transport Phosphorylation	18
1.1.3.6. Anaerobic Pathways	19
1.1.4. Enzymes	20
1.2. Foods composition	22
1.2.1. Introduction	22
1.2.1.1. Recommended Dietary Allowances (RDAs)	23
1.2.1.2. Healthy Eating Pyramid	24
1.2.1.3. The Importance of Whole Grains and Dietary Fibre	26
1.2.2. Carbohydrates	27
1.2.2.1. Diabetes mellitus	28
1.2.2.2. Diabetes insipidus	29
1.2.3. Proteins	30
1.2.4. Fats	32
1.2.5. Vitamins	34
1.2.5.1. Vitamin A (Retinol)	34
1.2.5.2. Vitamin D (Calciferol)	36
1.2.5.3. Vitamin E (Tocopherol)	38
1.2.5.4. Vitamin K (2-methyl-1,4-naphthoquinone)	40
1.2.5.5. Vitamin B1 (Thiamine)	42
1.2.5.6. Vitamin B2 (Riboflavin)	43
1.2.5.7. Vitamin B3 (Niacin / Nicotinic acid)	44
1.2.5.8. Vitamin B5 (Pantothenic acid)	46
1.2.5.9. Vitamin B6 (Pyridoxine)	46
1.2.5.10. Vitamin B7 or vitamin H (Biotin)	47
1.2.5.11. Vitamin B9 (Folic acid / Folacin)	48
1.2.5.12. Vitamin B12 (Cobalamin)	48
1.2.5.13. Vitamin C (Ascorbic acid)	48
1.2.6. Minerals	50
1.2.6.1. Calcium (Ca)	50
1.2.6.2. Phosphorus (P)	51

1.2.6.3. Magnesium (Mg).....	52
1.2.6.4. Sodium (Na).....	52
1.2.6.5. Potassium (K).....	52
1.2.6.6. Chloride (Cl).....	53
1.2.6.7. Sulfur (S).....	53
1.2.6.8. Iron (Fe).....	53
1.2.6.9. Iodine (I).....	54
1.2.6.10. Fluorine (F).....	54
1.2.6.11. Zinc (Zn).....	55
1.2.6.12. Copper (Cu).....	55
1.2.6.13. Manganese (Mn).....	55
1.2.6.14. Chromium (Cr).....	56
1.2.6.15. Selenium (Se).....	56
1.2.6.16. Cobalt (Co).....	56
1.2.6.17. Molybdenum (Mo).....	56
1.3. Nutritional and Eating Disorders	57
1.3.1. Nutritional Disorders	57
1.3.1.1. Malnutrition.....	57
1.3.1.2. Starvation	61
1.3.1.3. Obesity	62
1.3.2. Eating Disorders.....	66
1.3.2.1. Anorexia Nervosa.....	66
1.3.2.2. Bulimia Nervosa.....	67
1.3.2.3. Binge-eating Disorder	68
II. FOOD-BORNE DISEASES	69
2.1. Introduction	69
2.1.1. Factors of Food-borne Diseases Prevalence.....	70
2.1.1.1. Industrialization, Urbanization and Changing Lifestyle	70
2.1.1.2. Changing Population	70
2.1.1.3. International Trade in Food and Feed	70
2.1.1.4. Polluted Environment, Poverty, Lack of Food Preparation Facilities.....	71
2.1.1.5. Tourism	71
2.1.1.6. Knowledge, Beliefs and Practices of Food Handlers and Consumers	71
2.1.2. Developing Countries.....	73
2.1.3. Industrialized Countries	75
2.1.4. Cost of Food-borne Diseases.....	76
2.2. Biological Hazards.....	77
2.2.1. Pathogenic Bacteria.....	78
2.2.1.1. <i>Escherichia coli</i> O157:H7	78
2.2.1.2. <i>Salmonella</i> spp.	80
2.2.1.3. <i>Clostridium botulinum</i>	81
2.2.1.4. <i>Clostridium perfringens</i>	83
2.2.1.5. <i>Staphylococcus aureus</i>	83
2.2.1.6. <i>Campylobacter jejuni</i>	84
2.2.1.7. <i>Yersinia enterocolitica</i>	86
2.2.1.8. <i>Listeria monocytogenes</i>	88
2.2.1.9. <i>Vibrio cholerae</i> Serogroup O1	90
2.2.1.10. <i>Vibrio cholerae</i> Serogroup Non-O1.....	90
2.2.1.11. <i>Vibrio parahaemolyticus</i>	91
2.2.1.12. <i>Vibrio vulnificus</i>	92

2.2.1.13. <i>Bacillus cereus</i>	92
2.2.1.14. <i>Aeromonas hydrophila</i>	94
2.2.1.15. <i>Plesiomonas shigelloides</i>	94
2.2.1.16. <i>Shigella</i> ssp.	95
2.2.1.17. Miscellaneous enterics	97
2.2.1.18. <i>Streptococcus</i> spp.	97
2.2.2. Parasitic Protozoa and Helminths	99
2.2.2.1. <i>Giardia duodenalis</i> (<i>G. lamblia</i>)	99
2.2.2.2. <i>Entamoeba histolytica</i>	100
2.2.2.3. <i>Cryptosporidium parvum</i>	102
2.2.2.4. <i>Cyclospora cayetanensis</i>	103
2.2.2.5. <i>Anisakis simplex</i> and related worms	104
2.2.2.6. <i>Diphyllobothrium latum</i>	105
2.2.2.7. <i>Nanophyetus</i> spp.	106
2.2.2.8. <i>Eustrongylides</i> sp.	107
2.2.2.9. <i>Acanthamoeba</i> spp. and other free living amoebae	107
2.2.2.10. <i>Ascaris lumbricoides</i> and <i>Trichuris trichiura</i>	108
2.2.2.11. <i>Toxoplasma gondii</i>	109
2.2.2.12. <i>Trichinella spiralis</i>	110
2.2.2.13. <i>Taenia saginata</i> / <i>Taenia solium</i> (Tapeworms)	111
2.2.2.14. <i>Cysticercosis</i>	112
2.2.3. Viruses	113
2.2.3.1. Hepatitis A virus	113
2.2.3.2. Hepatitis E Virus	114
2.2.3.3. Rotaviruses	115
2.2.3.4. Norwalk Virus	116
2.2.3.5. Other Viral Agents	116
2.2.4. Moulds	118
2.2.5. Natural Toxins	123
2.2.5.1. Ciguatera Fish Poisoning	123
2.2.5.2. Shellfish Poisoning	124
2.2.5.3. Scombroid Poisoning (also called Histamine Poisoning)	125
2.2.5.4. Tetrodotxin	126
2.2.5.5. Mushroom Poisoning, Toadstool Poisoning	127
2.2.5.6. Mycotoxins	131
2.2.5.7. Pyrrolizidine Alkaloids Poisoning	134
2.2.5.8. Phytohaemagglutinin (Kidney Bean Lectin)	134
2.2.5.9. Grayanotoxin	136
2.2.6. Other Pathogenic Agents	137
2.2.6.1. Prions	137
2.3. Chemical Hazards	139
2.3.1. Naturally Occurring Chemicals - Contaminants	140
2.3.1.1. Mycotoxins	140
2.3.1.2. Scombrotxin	140
2.3.1.3. Ciguatoxin	140
2.3.1.4. Mushroom toxins	140
2.3.1.5. Shellfish toxins	140
2.3.1.6. Pyrrolizidine alkaloids	140
2.3.1.7. Phytohaemagglutinin	140
2.3.1.8. Polychlorinated biphenyls	140

2.3.1.9. 3-monochloropropane diol (3-MCPD).....	141
2.3.1.10. Dioxins	141
2.3.1.11. Polycyclic Aromatic Hydrocarbons (PAH).....	142
2.3.1.12. Acrylamide.....	143
2.3.1.13. Heavy metals.....	143
2.3.2. Added Chemicals.....	146
2.3.2.1. Food Additives	146
2.3.2.2. Veterinary Drugs and Feed Additives.....	146
2.3.2.3. Pesticides.....	147
2.4. Physical Hazards	149
2.5. Food Allergy and Intolerances	150
III. FOOD SAFETY ASSURANCE	156
3.1. Prevention of Food-borne Diseases.....	157
3.1.1. Prevention Strategy.....	157
3.1.1.1. Regulatory Measures.....	157
3.1.1.2. Educational Measures	157
3.1.1.3. Experience in Industrialized and Developing Countries.....	158
3.1.2. Food Chain (“from stable to table”).....	159
3.1.2.1. Three Lines of Defence	159
3.1.3. Ten Golden Rules of the WHO	161
3.1.4. HACCP System	163
3.1.4.1. Developing a HACCP Plan.....	164
3.1.4.2. Food Inspection and the HACCP System	166
3.1.5. Risk Analysis.....	168
3.1.5.1. Risk Assessment.....	169
3.1.5.2. Risk Communication.....	172
3.1.5.3. Risk Management.....	174
3.2. Food Technologies for Preservation	176
3.2.1. Physical Techniques	177
3.2.1.1. Irradiation	177
3.2.1.2. Cooking	178
3.2.1.3. Pasteurisation	179
3.2.1.4. Canning (Heat Sterilization).....	180
3.2.1.5. Drying.....	182
3.2.1.6. Cooling (Refrigeration).....	183
3.2.1.7. Freezing	184
3.2.1.8. Packaging	184
3.2.2. Chemical Techniques	187
3.2.2.1. Salting.....	187
3.2.2.2. Pickling.....	187
3.2.2.3. Smoking	188
3.2.2.4. Fermentation.....	189
3.2.2.5. Preservative Additives.....	189
IV. LITERATURE	191
4.1. Publications.....	191
4.2. Web Sites.....	192