

Contents

<i>Preface</i>	(v)
<i>Acknowledgements</i>	(vii)
<i>Contributing Authors</i>	(ix)
<i>Abbreviations</i>	(xxxix)

UNIT - I INTRODUCTION TO FUNCTIONAL FOODS AND NUTRACEUTICALS

CHAPTER - 1.1

History and Definition of Functional Foods and Nutraceuticals

Dr Rekha Sharma

Introduction	1
History of Functional Foods and Nutraceuticals	1
Definitions of Functional Foods and Nutraceuticals	5
Nutraceuticals	7
<i>Conclusion</i>	9
<i>References</i>	9

CHAPTER - 1.2

Classification of Functional Foods and Nutraceuticals

Dr Rekha Sharma

Introduction	11
Classification of Functional Foods and Nutraceuticals	11
<i>Conclusion</i>	20
<i>References</i>	20

CHAPTER - 1.3

Perceived Effects of Diet on Disease Prevention

Dr Renuka Mainde

Introduction	21
Functional Foods and Management of Diabetes	23
Functional Foods and Management of Cancer	24
Functional Foods and Management of Coronary Artery Disease	25
Benefits of Functional Foods through Bioactive Components	26
<i>Conclusion</i>	29
<i>References</i>	29

UNIT - II

PROBIOTICS

CHAPTER - 2.1

Introduction to Probiotics, Prebiotics and Synbiotics

Dr Rekha Sharma

Introduction	31
Introduction to Probiotics	31
Gut Microbiota	32
Factors Affecting the Composition of the Gut Microbiota	33
Introduction to Prebiotics	34
Fermentation of Prebiotics by Gut Bacteria	35
Persistence through the Colon	36
Mechanisms of Prebiotics	37
Characteristics of Probiotics and Prebiotics	37
Synbiotics	38
Postbiotics	39
<i>Conclusion</i>	39
<i>References</i>	40

CHAPTER - 2.2

Taxonomy and Important Features of Probiotic Microorganisms

Dr Preeti Dharmik

Definition of Taxonomy	41
Composition of Taxonomy	41
Classification	41
Nomenclature	41
Identification	42
Taxonomy and Classification of Lactobacillus	42
Taxonomy and Classification of Bifidobacterium	45
Taxonomy	45
<i>Conclusion</i>	51
<i>References</i>	51
<i>Weblinks</i>	51

CHAPTER – 2.3

Health Benefits of Probiotics

Dr Preeti Dharmik

Introduction	53
Mechanisms of Probiotic Function	53
<i>Conclusion</i>	61
<i>References</i>	62
<i>Weblinks</i>	62

CHAPTER - 2.4

Probiotics in various Foods: Fermented Milk Products, Non-milk Products etc.

Dr Rekha Sharma

Introduction	64
Probiotics in Dairy Foods	65
The Role(s) of Probiotics Bacteria in Dairy Fermentations	65
Role of Milk and Milk Fat	66
Role of Prebiotics in Dairy Foods	66
Examples of Dairy-Based Probiotic Foods	66
Probiotics in Non-Dairy Foods	68
Non-Dairy Probiotic Foods	68

(xiv) Contents

<i>Conclusion</i>	71
<i>References</i>	71
<i>Weblinks</i>	72

CHAPTER - 2.5

Quality Assurance of Probiotics and Safety

Dr Preeti Dharmik

Introduction	73
Probiotics Selection	74
General Aspects	75
Quality Control Aspects	78
Probiotic Labeling	78
<i>Conclusion</i>	79
<i>References</i>	79
<i>Weblinks</i>	80

**UNIT - III
PREBIOTICS**

CHAPTER - 3.1

Oligosaccharides

Dr Renuka Mainde

Definition	81
Functional Oligosaccharides	81
Mechanism of Action	82
Health Benefits of Functional Oligosaccharides	82
Lacto-Sucrose	85
Malto-Oligosaccharides	88
Isomalto- oligosaccharides	89
Soy-oligosaccharides	91
<i>Conclusion</i>	92
<i>References</i>	92

CHAPTER – 3.2

Dietary Fiber

Dr Renuka Mainde

Introduction	94
Definition of Dietary Fiber	94
Classification of Dietary Fiber	95
Sources of Dietary Fiber	96
Physico-Chemical Properties of Fiber	98
Effects of Processing on Dietary Fiber Contents of Food	99
Health Benefits of Dietary Fiber	100
Applications of Dietary Fiber as a Functional Food	102
<i>Conclusion</i>	102
<i>References</i>	103

CHAPTER – 3.3

Resistant Starch

Dr Renuka Mainde

Introduction	105
Structure and Classification of Resistant Starch	105
Food Sources of Resistant Starch	106
Calorific Value and Dietary Intakes of Resistant Starch	107
Measurement of Resistant Starch	107
Gut Bacterial Metabolism of Resistant Starch	107
Short Chain Fatty Acids	108
Physiological Effects of Resistant Starch	108
Health Benefits of Resistant Starch	109
Potential for Product Development of Resistant Starch	111
<i>Conclusion</i>	111
<i>References</i>	112

CHAPTER – 3.4

Gums

Dr Avanti Prabhakar

Introduction	113
--------------------	-----

Dietary Gum: Chemistry and Properties	114
Gum Arabic	115
Chemistry and Structure	116
Physico-chemical Characteristics of Gum Arabic	116
Pharmacological Properties of Gum Arabic	116
Gums as Food Additives	117
Regulatory Status as Additive	118
<i>Conclusion</i>	120
<i>References</i>	120

UNIT - IV
OTHER FOOD COMPONENTS WITH
POTENTIAL HEALTH BENEFITS

CHAPTER - 4.1

Polyphenols

Dr Shakti Sharma

Introduction	123
Chemical Structure of Polyphenols	123
Sources of Flavonoids	129
Digestion and Absorption of Flavonoids	130
Bioavailability of Flavonoids	131
Effect of Processing on Flavonoids	131
Health Benefits of Flavonoids	132
<i>Conclusion</i>	133
<i>References</i>	134
<i>Weblinks</i>	135

CHAPTER - 4.2

Tannins and Catechins

Dr Renuka Mainde

TANNINS	136
---------------	-----

Introduction	136
What are Tannins?	136
Sources of Tannins	139
Metabolism of Tannins	140
Bioavailability of Tannins	140
Effect of Processing on Tannins	140
Physiological Effects and Health Benefits of Tannins	141
Applications of Tannins	142
<i>Conclusion</i>	142
<i>References</i>	142
CATECHINS	144
Introduction	144
Chemistry of Catechins	144
Sources of Catechins	145
Effect Processing on Catechins	146
Metabolism and Bioavailability of Catechins	146
Health Benefits of Catechins	147
Potential Applications of Catechins	149
<i>Conclusion</i>	149
<i>References</i>	149

CHAPTER - 4.3

Phytoestrogens

Dr Shakti Sharma

Introduction	151
Definition and Origin	151
Classification of Phytoestrogens	152
Isoflavones	153
Coumestans	153
Lignans	154
Dietary Sources of Phytoestrogens	154
Phytoestrogens Contents of Foods	156
Effects of Processing	157

(xviii) Contents

Absorption, Distribution, Metabolism and Excretion of Phytoestrogens	157
Health Benefits of Phytoestrogens	157
Deleterious Effects of Phytoestrogen	159
The Perspective of Food Applications of Phytoestrogens	159
<i>Conclusion</i>	160
<i>References</i>	161

CHAPTER - 4.4

Phytosterols

Dr Avanti Prabhakar

Introduction	163
Types of Phytosterol	163
Sources of Phytosterol	165
Phytosterol Contents of Foods	166
Effects of Processing	167
Absorption and Metabolism	168
Effects on Human Health	168
Supplements	170
Safety	170
Adverse Effects	170
<i>Conclusion</i>	171
<i>References</i>	171

CHAPTER - 4.5

Glucosinolates

Dr Rekha Sharma

Introduction	173
Definition	173
Chemistry	174
Hydrolysis of Glucosinolates	175
Metabolism and Bioavailability	176
Effect of Processing	177

Physiological Effects	177
Antioxidant Effect	178
Anti Inflammatory Effects	179
Cancer Protective Effects	179
Neurological Diseases (Neurodegenerative Diseases)	180
Antidiabetic Effect	180
Cholesterol Lowering Effect	180
Toxic Effects of Glucosinolates	180
Goitrogenic Effect	181
<i>Conclusion</i>	181
<i>References</i>	181

CHAPTER - 4.6

Carotenoids and Anthocyanins

Dr Renuka Mainde

Introduction	183
Chemistry and Structure	183
Food Sources	184
Absorption and Metabolism	185
Bioavailability of Carotenoids	185
Effect of Food Processing	186
Health Benefits of the Carotenoids	186
Carotenoids in Food Products	187
<i>Conclusion</i>	188
Anthocyanins	188
Chemistry and Structure	189
Absorption, Metabolism and Bioavailability of Anthocyanins	190
Health Benefits	190
Anthocyanins for Commercial Use	191
<i>Conclusion</i>	191
<i>References</i>	192

CHAPTER - 4.7

Lycopene

Dr Renuka Mainde

Introduction	193
Chemistry of Lycopene	193
Physical Properties of Lycopene	195
Sources of Lycopene	195
Digestion and Absorption of Lycopene	196
Transportation of Lycopene	197
Metabolism of Lycopene	197
Bioavailability of Lycopene	198
Effects of Processing on Lycopene	199
Health Benefits of Lycopene	200
Lycopene and Coronary Heart Disease	200
Lycopene and Cancer	201
Diabetes and Lycopene	201
Oxidative Metabolite of Lycopene	201
Skin Aging and Lycopene	202
Commercial Products of Lycopene	202
<i>Conclusion</i>	203
<i>References</i>	204

CHAPTER - 4.8

Curcumin

Dr Renuka Mainde

Introduction	206
Chemical Structure	206
Sources of Curcumin	207
Metabolism of Curcumin	208
Bioavailability of Curcumin	210
Effects of Processing on Curcumin	210
Health Benefits of Curcumin	211
Commercial Products of Curcumin	214

Safety	214
<i>Conclusion</i>	214
<i>References</i>	215

CHAPTER - 4.9

Organosulfur Compounds

Dr Avanti Prabhakhar

Introduction	217
Various Organosulfur Compounds and their Properties	218
Sources of Organosulfur Compounds	218
Organosulfur Compound from Garlic	219
Recommended Intake	221
Effect of Processing	221
Metabolism and Bioavailability	221
Beneficial Health Effects	222
Toxic Effects	224
Commercial Garlic Supplements	225
<i>Conclusion</i>	225
<i>References</i>	225
<i>Weblinks</i>	226

CHAPTER - 4.10

An Introduction to Antinutritional Factors in Plant Foods

Dr Sabiha Vali

Introduction	227
Classification of Antinutritional Factors	228
Toxic Constituents and their Biological Effects	236
Elimination of Antinutritional Substances	237
<i>Conclusion</i>	239
<i>References</i>	240

CHAPTER - 4.10A

Phytate

Dr Srilakshmi Potluri

Introduction	242
--------------------	-----

(xxii) **Contents**

Definition	242
History	243
Sources of Phytate in Foods	243
Effect of Processing	244
Mechanism of Phytate Hydrolysis in the Gut	245
Physiological Effects	246
Beneficial Effects of Phytates	247
Perceived Effects of Phytic Acid in Risk Reduction of Diseases	248
Heart Disease	248
Hypo-Glycemic Effects	249
Other Diseases	249
<i>Conclusion</i>	249
<i>References</i>	250
<i>Weblinks</i>	250

CHAPTER - 4.10B

An Introduction to Enzymes

Dr Pratima Shastri

Introduction	251
Specificity of Enzymes	252
Naming and Classification	252
Chemical Nature of Enzymes	253
Coenzyme Functions of Vitamins	254
Mechanism of Enzyme Catalysed Reaction	255
Digestion of Foods in the Human Digestive System	258
Digestive Enzymes	258
Role of Digestive Enzymes	258
Enzyme-Related Metabolic Disorders	258
Management of Inherited Metabolic Disorders	259
<i>Conclusion</i>	260
<i>References</i>	260

CHAPTER - 4.10C

Protease Inhibitors

Dr Rekha Sharma

Introduction	262
What is a Protease?	262
Protease Inhibitors	264
Classification of Protease Inhibitors	264
By protease	264
By mechanism	265
Trypsin Inhibitor from Soybean	265
Proteases of the Gastro-Intestinal Tract	265
Protease Inhibitors of Gastro-Intestinal Tract	266
Mechanism of Protease Inhibition	266
Sources of Protease Inhibitors	266
Effects of Processing on Protease Inhibitors	267
Physiological Benefits	267
Protease Inhibitors and HIV	267
Protease Inhibitors and Cancer	268
Protease Inhibitors and Gastrointestinal Diseases	269
<i>Conclusion</i>	270
<i>References</i>	270

CHAPTER - 4.10D

Amylase Inhibitor

Dr Pratima Shastri

Introduction	272
Endo Amylase or α Amylase	273
Exoamylases	274
Digestion of Starch in the Human Digestive System	276
Health benefits of α - Amylase Inhibitors	276
Diabetes mellitus (DM)	276
Dental Caries and Periodontal Diseases	276

(xxiv) Contents

Obesity	277
Inhibitors of α Amylase from Plants	277
Phytoconstituents with Amylase Inhibitory Activity	278
<i>Conclusion</i>	280
<i>References</i>	280

CHAPTER - 4.10E

Saponins and Haemagglutinins

Dr Renuka Mainde

Introduction	282
Physical and Chemical Properties of Saponins	283
Sources of Saponins	283
Digestion and Absorption of Saponins	285
Effects of Processing	285
Health Effects of Saponins	285
Anti-hypercholesterolemic Activity	285
Cytotoxic and Antitumor Activity	286
Antiviral Activity	286
Antidiabetic Activity	286
Action on Blood Pressure	286
Action on Central Nervous System	287
Toxic Effects of Saponins	287
Applications of Saponins as Commercial Product	287
<i>Conclusion</i>	287
Haemagglutinin	288
General Properties	289
Structure	290
Sources	290
Effect of Processing on Lectins and Hemagglutinins	290
Soaking	291
Boiling	291
Functions of Lectins	291

Toxic Effects of Lectins	292
<i>Conclusion</i>	292
<i>References</i>	293

CHAPTER – 4.11

An Introduction to Active Biodynamic Principles in Spices, Condiments and Other Plant Materials

Dr Rekha Sharma

Introduction	294
What are Bioactive Compounds?	294
What are Spices?	295
Bioactive Compounds in Spices and Condiments	296
Mechanism of Action of Spices as an Antioxidant	299
Anti-Inflammatory Role of Spices	301
Physiological Effects of Active Components of Spices	301
Beneficial Health Effects of Spices	308
<i>Conclusion</i>	313
<i>References</i>	314

CHAPTER - 4.11A

Resveratrol

Dr Renuka Mainde

Introduction	315
Chemistry of Resveratrol	315
Sources of Resveratrol	316
Effect of Processing on Resveratrol	316
Metabolism and Bioavailability	317
French Paradox	318
Physiological Effects and Health Benefits of Resveratrol	319
Prooxidant and Antioxidant Activities of Resveratrol	319
Anti-Cancer Effect of Resveratrol	319
Neuroprotective Effect of Resveratrol	320
Anti-Inflammatory Activity	320
Cardiovascular Protection	320

Non-alcoholic Fatty Liver Disease (NAFLD)	321
Perspectives of Food Application of Resveratrol	321
Supplements	321
Drug Interactions	322
<i>Conclusion</i>	322
<i>References</i>	322

CHAPTER - 4.11B

Quercetin and Kaempferol

Dr Renuka Mainde

QUERCETIN	324
Introduction	324
Chemistry and Structure of Quercetin	324
Sources of Quercetin	325
Effect of Processing on Quercetin	326
Metabolism and Bio-availability of Quercetin	326
Health Benefits of Quercetin	327
Anti-inflammatory Activity	327
Antiviral Activity	328
Cardiovascular Protection	328
Neuroprotective Effect	328
Anti-cancer Activity	329
Ulcer and Gastritis	329
Other Clinical Effects	329
Perspectives of Quercetin in Product Development	329
<i>Conclusion</i>	330
<i>References</i>	330
KAEMPFEROL	331
Sources of Kaempferol	331
Metabolism of Kaempferol	332

Health Benefits of Kaempferol	332
Cardiovascular Disorders	333
<i>Conclusion</i>	333
<i>References</i>	334

CHAPTER - 4.11C

Cinnamaldehyde, Crocin and Luteolin

Dr Shakti Sharma

CINNAMALDEHYDE	335
Introduction	335
Chemical Structure of Cinnamaldehyde	335
Metabolism of Cinnamaldehyde	336
Beneficial Effects of Cinnamaldehyde	336
Cinnamaldehyde Restricts the Harmful Blood Platelet Clotting	336
As an Anti-bacterial and Anti-fungal Agent	336
Anti-diabetic Property	337
Anticancer	337
Anti-Inflammatory Effect	337
Potential uses of Cinnamaldehyde	337
Insecticide and Mosquito Repellent	338
<i>Conclusion</i>	338
<i>References</i>	338
CROCIN	339
Introduction	339
Chemical Structure of Crocin	339
Absorption and Bioavailability of Crocin	339
Health Benefits of Crocin	340
Anti-Oxidant Activity of Crocin	341
Hypolipidemic Effect of Crocin	341
Hypoglycemic and Anti-Diabetic Effects	342
Anti-Depressant and Mood Improving Effects	342

Anti-cancer Properties	342
<i>Conclusion</i>	343
<i>References</i>	343
LUTEOLIN	343
Introduction	343
Structure of Luteolin	344
Sources of Luteolin	344
Metabolism of Luteolin	345
Health Benefits of Luteolin	345
Anti-inflammatory Property	345
Anti-carcinogenic Properties	345
Protection from Carcinogenic Agents	346
Anti-oxidant Property	346
<i>Conclusion</i>	346
<i>References</i>	347

CHAPTER - 4.11D

Capsaicin

Dr Renuka Mainde

Introduction	348
Structure of Capsaicin	349
Metabolism and Bioavailability of Capsaicin	350
Sources of Capsaicin	350
Effect of Processing on Capsaicin and Product Development	350
Health Benefits of Capsaicin	352
Capsaicin and Parkinson's Disease	352
Capsaicin and Heart Disease	353
Capsaicin and Cancer	353
Capsaicin and Obesity	353
Capsaicin and Diabetes Management	354
Capsaicin for Osteoarthritis Pain	354
<i>Conclusion</i>	354
<i>References</i>	355

CHAPTER - 4.11E

Piperine

Dr Renuka Mainde

Introduction	357
Sources of Piperine	357
Structure of Piperine	358
Bioavailability of Piperine	358
Effect of Processing on Piperine	359
Safety and Recommended Dose	359
Biological Activity and Health Benefits of Piperine	359
Piperine as Anti-allergic Agent	360
Role of Pepper Species in Traditional Medicine	360
Analgesic and Anti-inflammatory Activity	361
Antidepressant Potential	361
Antioxidant Activity of Piperine	362
Anticancer Activity of Piperine	362
Neuroprotective Effect of Piperine	362
Antidiabetic Effect of Piperine	362
<i>Conclusion</i>	363
<i>References</i>	363
<i>Weblinks</i>	364

CHAPTER - 4.11F

Eugenol

Dr Renuka Mainde

Introduction	365
Chemical Structure and Properties of Eugenol	365
Structure of Eugenol	366
Safety of Eugenol	366
Health Benefits of Eugenol	367
Wide Application of Eugenol in Dentistry	367
Anticancer Activities of Eugenol	368
Antioxidant Activity of Eugenol	368

Cardioprotective Effect of Eugenol	369
Antidiabetic Activity of Eugenol	369
Anti-Inflammatory Activity	369
Antimicrobial Activity of Eugenol	369
<i>Conclusion</i>	370
<i>References</i>	370
<i>Weblinks</i>	371

CHAPTER - 4.11G

Gingerol

Dr Renuka Mainde

Introduction	372
Chemical Composition and Molecular Structure	373
Sources	373
Effect of Processing on Gingerol	374
Bioavailability of Gingerol	374
Safety and Interaction of Gingerol	375
Health Benefits of Gingerol	375
Anti-Inflammatory Effect	375
Antioxidant Effect	375
Anti-Emetic Activity	376
Ginger in Dysmenorrhea	376
Anticancer Properties of Gingerol	377
Neuroprotection and Gingerol	377
Cardiovascular Protection	377
Antiobesity Activity of Gingerol	378
<i>Conclusion</i>	378
<i>References</i>	378

CHAPTER - 4.11H

Apigenin

Dr Renuka Mainde

Introduction	380
Structure and Properties of Apigenin	380
Dietary Sources of Apigenin	381
Bioavailability and Metabolism	382
Health Benefits of Apigenin	382
Antidiabetic Properties of Apigenin	383
The Beneficial Role of Apigenin in Amnesia and Alzheimer’s Disease	383
Beneficial Effects of Apigenin in Insomnia and Depression	383
Apigenin and Cancer	384
Antimicrobial and Antiviral Activity of Apigenin	384
Apigenin and Rheumatoid Arthritis	384
<i>Conclusion</i>	384
<i>References</i>	385
<i>Weblinks</i>	385

CHAPTER - 4.11I

Rosmarinic Acid

Dr Renuka Mainde

Introduction	386
Structure	386
Sources	387
Metabolism of Rosmarinic Acid	387
Bioavailability of Rosmarinic Acid	388
Application as Antioxidant	388
Health Benefits of Rosmarinic Acid	389
Anticancer Potential of Rosmarinic Acid	389
Antidiabetic Activity of Rosmarinic Acid	390
Arthritis	390
Allergic Rhinitis	390
Antimicrobial Activity	391

Cardioprotective Activity	391
<i>Conclusion</i>	391
<i>References</i>	391
<i>Weblinks</i>	392

CHAPTER - 4.11J

Thymoquinone

Dr Renuka Mainde

Introduction	393
Structure	394
Composition of <i>Nigella sativa L.</i>	394
Bioavailability of Thymoquinone	395
Health Benefits of Thymoquinone	395
Thymoquinone and COVID 19	396
Antiviral Activity of Thymoquinone	396
Immunomodulatory Effect of Thymoquinone	397
Anticoagulation Effect of Thymoquinone	397
Antioxidant Effect of Thymoquinone	398
Nephroprotective Effects of Thymoquinone	398
Thymoquinone and Diabetes	398
Anti-Arthritic Action of Thymoquinone	399
Neuroinflammation and Thymoquinone	399
<i>Conclusion</i>	399
<i>References</i>	400

CHAPTER - 4.11K

Fenugreek and Diosgenin

Dr Renuka Mainde

Introduction	401
Bioactive Compounds in Fenugreek	401
Fenugreek Seeds	402
Fenugreek Gum	403
Fenugreek Oil	403

Effect of Processing on Fenugreek Seeds	403
Fenugreek Seeds as an Emulsifier	404
Fenugreek Seeds as Probiotic	404
Culinary use of Fenugreek Leaves and Seeds	404
Health Benefits of Fenugreek	405
Fenugreek and Type 2 Diabetes	405
Fenugreek and Cholesterol Lowering Effect	406
Application as a Galactagogue	406
Fenugreek and Antioxidant Activity	406
Fenugreek and Anticancer Properties	407
Fenugreek and Effect on Digestion	407
<i>Conclusion</i>	407
<i>References</i>	407
DIOSGENIN	408
Introduction	408
Structure and Chemistry	409
Bioavailability	410
Sources	410
Health Benefits	410
Diosgenin and Diabetes	411
<i>Conclusion</i>	411
<i>References</i>	411

UNIT - V

NON-NUTRIENT EFFECTS OF SPECIFIC NUTRIENTS

CHAPTER – 5.1

Proteins, Peptides and Nucleotides

Dr Sabiha Vali

Introduction	413
PROTEINS	413
Sources of Protein	414
Multiple Roles of Protein	414

PEPTIDES	417
Bioactive Peptides	417
Production of Bioactive Peptides	417
Absorption of Bioactive Peptides	418
Sources of Bioactive Peptides	418
Regulatory Environment for Bioactive Peptides	419
Challenges for Oral use of Bioactive Peptides	420
NUCLEOTIDES	420
Structure of Nucleotides	421
Physiological Role of Nucleotides	421
Beneficial Effects of Nucleotides	421
<i>Conclusion</i>	422
<i>References</i>	423
<i>Weblinks</i>	424

CHAPTER – 5.2

Conjugated Linoleic Acid

Dr Avanti Prabhakhar

Introduction	425
Definition and Chemistry	425
Natural Sources of Conjugated Linoleic Acid	426
Artificial Sources of Conjugated Linoleic Acid	427
Effect of Processing on Conjugated Linoleic Acid	427
Metabolism and Bioavailability of Conjugated Linoleic Acid	427
Physiological Effects and Health Benefits of Conjugated Linoleic Acid	428
Reduction in Body Fat Percent	429
Obesity and Loss of Body Fat	430
Prevention of Cardiovascular Diseases	430
Cancer Prevention	431
The Perspective of Food Applications of Conjugated Linoleic Acid	431
Safety Concerns of CLA Supplementation	431
<i>Conclusion</i>	432
<i>References</i>	432

CHAPTER – 5.3

Omega-3 Fatty Acids

Dr Avanti Prabhakhar

Introduction	435
Fats and Fatty Acids	436
<i>Cis</i> and <i>Trans</i> Fats	437
Sources of Omega-3 Fatty Acid	438
Effect of Processing on Omega-3 Fatty Acids	439
Metabolism and Bioavailability of Omega-3 Fatty Acids	440
Physiological Effects and Health Benefits	441
Cardiovascular Diseases	442
Infant Health and Development	442
Cancer Prevention	443
Alzheimer’s Disease, Dementia and Cognitive Function	443
Vision	443
Rheumatoid Arthritis	444
Other Health Conditions	444
Safety of Omega–3 Fatty Acids	444
The Perspective of Food Applications	445
Cooking Oils	445
<i>Conclusion</i>	446
<i>References</i>	446

CHAPTER – 5.4

Vitamins

Dr Sabiha Vali

Introduction	448
Fat- and Water-Soluble Vitamins	448
Fat Soluble Vitamins	449
Water Soluble Vitamins	449
VITAMIN A	450
Sources of Vitamin A	450

Health Benefits of Vitamin A	450
VITAMIN D	451
Sources of Vitamin D	451
Health Benefits of Vitamin D	452
VITAMIN E	452
Sources of Vitamin E	453
Health Benefits of Vitamin E	453
VITAMIN K	454
Sources of Vitamin K	454
Health Benefits of Vitamin K	454
WATER SOLUBLE VITAMINS	455
Vitamin C (Ascorbic Acid)	455
Sources of Vitamin C	455
Health Benefits of Vitamin C	456
THIAMINE (VITAMIN B1)	457
Sources of Thiamine.....	457
Health Benefits of Thiamine	457
Riboflavin (VITAMIN B2)	458
Sources of Riboflavin.....	458
Health Benefits of Riboflavin.....	459
NIACIN (VITAMIN B3)	459
Sources of Niacin	460
Health Effects of Niacin	460
VITAMIN B ₆ (PYRIDOXINE)	461
Sources of Vitamin B6	461
Health Benefits of Vitamin B6	461
COBALAMIN (VITAMIN B12)	462
Sources of Vitamin B12	462
Health Benefits of Cobalamin	463
FOLATE	463
Sources of Folate	463
Health Benefits of Folate	464

Pantothenic Acid and Biotin.....	464
<i>Conclusion</i>	466
<i>References</i>	466
<i>Weblinks</i>	469

CHAPTER – 5.5

Minerals

Dr Sabiha Vali

Introduction	472
MACRO MINERALS	472
CALCIUM	472
Sources of Calcium	472
Health Benefits of Calcium	473
PHOSPHORUS	474
Sources of Phosphorus	474
Health Benefits of Phosphorus	475
MAGNESIUM	475
Sources of Magnesium	475
Health Benefits of Magnesium	476
SODIUM, POTASSIUM AND CHLORIDE.....	476
SODIUM	477
Sources of Sodium.....	477
Health Effects of Sodium	477
POTASSIUM	477
Sources of Potassium.....	477
Health Benefits of Potassium	478
MICRO MINERALS	478
IRON	478
Sources of Iron	478
Health Effects of Iron	479
ZINC	479
Sources of Zinc.....	479
Health Benefits of Zinc	480
COPPER	480

(xxxviii) Contents

Sources of Copper	481
Health Benefits of Copper	481
SELENIUM	482
Sources of Selenium	482
Health Benefits of Selenium	482
CHROMIUM	483
Sources of Chromium.....	483
Health Benefits of Chromium	483
MANGANESE	484
Sources of Manganese.....	484
Health Benefits of Manganese	484
IODINE	485
Sources of Iodine.....	485
Health Benefits of Iodine	486
FLUORIDE	486
Sources of Fluoride	487
Health Benefits of Fluorine	487
<i>Conclusion</i>	487
<i>References</i>	488
<i>Weblinks</i>	489
Index	491