Contents

Pre	tribute face out the	ors Editors		xv xvii <i>xix</i>
1	A W	indow to	oods, Nutraceuticals, and Disease Prevention: the Future of Health Promotion Paliyath and Kalidas Shetty	3
	1.1		c Degenerative Diseases in Modern Society: Implications on Life y, Productivity, Economic Burden Diet and lifestyle changes: the missing foods Social and economic burden of chronic degenerative diseases	3 3 4
	1.2	Health 1.2.1 Referei	Regulatory Properties of Foods: "Prevention Is Better Than Cure" Fruit and vegetable consumption and disease prevention	5 6 8
2			oods and Nutraceuticals Jackson and Gopinadhan Paliyath	11
	2.1	Introdu	iction	11
	2.2	Definit 2.2.1	ion of Functional Foods and Nutraceuticals Effects of functional foods and nutraceuticals on	12 16
	2.3	Source	major chronic diseases s and Biological Effects of Functional Foods and	10
	2.5		euticals in Nature	19
		2.3.1	Flaxseed (Linum usitatissimum)	20
		2.3.2	Phytoestrogens	21
		2.3.3	Tomatoes	21
		2.3.4	Garlic (Allium sativum)	21
		2.3.5	Cruciferous vegetables	22
		2.3.6	Citrus fruits	22
		2.3.7 2.3.8	Cranberry	23 23
		2.3.8 2.3.9	Tea Wine and grapes	23 24

v

3

	2.3.10	Chocolate	24
	2.3.11	Fish	25
	2.3.12	Dairy products	25
	2.3.13	Carbohydrates	26
	2.3.14	Meat	26
	2.3.15	Vitamins	26
	2.3.16	Minerals	27
2.4	Functio	onal Foods and Nutraceuticals: Health Claims and Benefits	27
	2.4.1	Oats	27
	2.4.2	Psyllium	27
	2.4.3	Soybeans	28
	2.4.4	Phytosterols	29
	2.4.5	Fiber	29
	2.4.6	D-Tagatose	29
2.5	Qualifi	ed Health Claims	29
	2.5.1	Selenium and cancer	29
	2.5.2	Antioxidant vitamins and cancer	30
	2.5.3	Nuts (e.g., walnuts) and heart disease	30
	2.5.4	Omega-3 fatty acids and CHD	30
	2.5.5	Phosphatidylserine/Phosphatidylcholine and	
		cognitive dysfunction and dementia	30
	2.5.6	Folic acid and neural tube birth defects	30
2.6		onal Foods and Nutraceuticals: Safety Issues	30
	2.6.1	Echinacea	31
	2.6.2	Ephedra (also called "ma huang, herbal ecstasy,	
		or mahuanggen")	31
	2.6.3	Feverfew	31
	2.6.4	Garlic	31
	2.6.5	Ginger	32
	2.6.6	Gingko biloba	32
	2.6.7	Ginseng	32
	2.6.8	Kava kava products	32
	2.6.9	St. John's Wort	32
2.7	-	tion of Functional Foods and Nutraceuticals	33
2.8		Education and Dietary Guidance	35
2.9		ding Remarks	36
	Referen	nces	37
		enomics: Fundamental Role of Diet in Chronic Disease	
		nd Control	45
Amy	J. TUCKE	r, Branden Deschambault, and Marica Bakovic	
3.1	Introdu	ction	45
3.2	Nutrige	enetics	46
	3.2.1	Gene polymorphisms	46
	3.2.2	Single nucleotide polymorphisms (SNPs)	47
	3.2.3	Nonsynonymous single nucleotide polymorphisms (nsSNPs)	47
	3.2.4	Regulatory single nucleotide polymorphisms (rSNPs)	48
	3.2.5	Splice site single nucleotide polymorphisms (ssSNPs)	48

		3.2.6 Trans-Acting rSNPs	48
	3.3	Complexities of chronic disease research in nutrigenetics	49
	3.4	Chronic Disease and Rare SNPs	50
		3.4.1 Copy number variants	50
	3.5	CVD and Nutrigenetics	51
	3.6	Nutrigenetics and Cancer	51
	3.7	Summary of Nutrigenetic Research Potential	51
	3.8	Nutriepigenetics	52
		3.8.1 Role of the epigenome	52
		3.8.2 Cause of epimutations	52
	3.9	Epimutations in Chronic Disease	53
		3.9.1 Epimutations and macronutrients/micronutrients	53
		3.9.2 Epimutations and phytochemicals	54
	3.10	Summary of Epigenetic Research Potential	54
	3.11	Nutrigenomics	54
		3.11.1 Genomic impact of diet	55
		3.11.2 Carbohydrates and gene interactions	55
		3.12.3 Cholesterol and gene interactions	56
		3.11.4 FAs, lipids, and gene interactions	58
		3.11.5 Lipids and APOE	59
		3.11.6 Diet and APOE	60
		3.11.7 Lipids and hepatic lipase (HL)	60
		3.11.8 Diet and LIPC	61
		3.11.9 Interaction between APOE and HL	61
	3.12	Vitamin A and Gene Interactions	61
		3.12.1 Dual roles of vitamin A	62
	3.13	Vitamin E and Nutrigenomics	62
		3.13.1 Vitamin E and atherosclerosis	62
		3.13.2 Vitamin E and cholesterol biosynthesis	63
	3.14	Vitamin D and Gene Interactions	63
		3.14.1 Vitamin D and breast cancer	63
		3.14.2 Vitamin D and FAs	64
	3.15	Phytoestrogens and Gene Interactions	64
		3.15.1 Phytoestrogens and breast cancer	64
		3.15.2 Phytoestrogens and lipid, glucose metabolism	64
	3.16	Phytosterols and Gene Interactions	65
		3.16.1 Phytosterols and cholesterol metabolism	65
		3.16.2 Phytosterols and cancer	65
	3.17	Polyphenols and Gene Interactions	65
		3.17.1 Polyphenols and CVD	65
		3.17.2 Polyphenols and cancer	66
	3.18	Nutrigenomics Summary: Advantages, Limitations, Future	66
	3.19	Conclusions	67
		References	67
4	Nutra	aceuticals and Antioxidant Function	75
	Denis	se Young, Rong Tsao, and Yoshinori Mine	

	4.2	Oxidative Stress and ROS	75
		4.2.1 Endogenous sources of ROS	76
		4.2.2 Exogenous sources of ROS	77
	4.3	Antioxidants and Antioxidative Defense Systems	77
		4.3.1 Endogenous antioxidants and antioxidative defenses	77
		4.3.2 Dietary antioxidants	79
	4.4	Phytochemicals	79
		4.4.1 Polyphenols	80
		4.4.2 Amides	85
		4.4.3 Carotenoids	86
		4.4.4 Mechanism of antioxidant action	87
	4.5	Antioxidant Amino Acids, Peptides, and Proteins	90
	4.6	Mechanism of Action of Antioxidant and Antioxidative	
		Stress Amino Acids, Peptides, and Proteins	91
		4.6.1 Amino acids	91
		4.6.2 Peptides and proteins	91
	4.7	Production of Antioxidant Peptides	95
	4.8	Recent Advances in Analytical Techniques for Measuring Antioxidant	
		Capacity and Oxidative Damage	96
		4.8.1 Chemical antioxidant capacity assay	96
		4.8.2 Cell-based antioxidant assays	99
	4.9	Health Benefits of Nutraceutical Antioxidants	101
		4.9.1 Evidence of antioxidant efficacy in disease states	101
		4.9.2 Failure of antioxidants to demonstrate efficacy	102
	4.10	Conclusion	102
		References	103
5	Comj	position and Chemistry of Functional Foods and	
	Nutra	aceuticals: Influence on Bioaccessibility and Bioavailability	113
	Jissy	K. Jacob and Gopinadhan Paliyath	
	5.1	Introduction	113
	5.2	Polyphenols as Antioxidants	115
	0.2	5.2.1 Free radicals and endogenous antioxidant	
		defense mechanisms	115
		5.2.2 Diet and exogenous antioxidants (flavonoids)	115
		5.2.3 Antioxidant properties of flavonoids	117
	5.3	Antioxidant Activity of Anthocyanins	118
	5.4	Anthocyanin Biosynthesis and Localization	119
	5.5	Bioaccessibility and Bioavailability of Polyphenols	121
	5.6	Microstructural Characteristics of Grape Juice	122
	5.7	Physicochemical Properties of the Dialyzed Juice Fraction	123
	5.8	Ultrastructural Analysis of Juice Fractions	124
	5.9	Composition of Juice Fractions	126
	5.10	Antioxidant Activity of Juice Fractions	129
	5.11	Metabolism and Bioavailability of Flavonoids	132
	5.12	Dietary Polyphenols and Prevention of Diseases	135
		5.12.1 Polyphenols and cardiovascular diseases	135

		5.12.2	Polyphenols and cancer	136
	5.13		ing Health Beneficial Properties of Juices	137
		Referen	nces	139
6	Cruc	iferous V	Vegetable-Derived Isothiocyanates and	
		er Preve		147
	Ravi	P. Sahu a	and Sanjay K. Srivastava	
	6.1	Introdu	ction	147
	6.2		olism of Xenobiotics	149
	6.3		nd Inhibition of Cancer	150
		6.3.1	Pancreatic cancer	150
		6.3.2	Brain cancer	152
		6.3.3	Prostate cancer	152
		6.3.4	Lung cancer	154
		6.3.5	Breast cancer	155
		6.3.6	Colon cancer	156
		6.3.7	Hepatic cancer	156
		6.3.8	Bladder cancer	157
		6.3.9	Multiple myeloma (MM)	158
		6.3.10 6.3.11	1	159
			Skin cancer	159 160
			wledgments	160
		Referen	-	161
7	The	Diagona	Proventive Detential of Some Denvior and	
7		rutilized	Preventive Potential of Some Popular and	171
		ev Bhat	i Secus	1/1
	Ū.		ation	171
	7.1 7.2	Introdu		171 172
	1.2	7.2.1	eds and Their Therapeutic Potential Nigella seeds (Nigella sativa L.)	172
		7.2.1	Sunflower seed (<i>Helianthus annuus</i> L.)	172
		7.2.2	Groundnut seed (Arachis hypogea L.)	183
		7.2.3	Sesame seeds (<i>Sesamum indicum</i> L.)	185
		7.2.5	Oilseed rape (<i>Brassica napus</i> L.)	184
		7.2.6	Safflower (<i>Carthamus tinctorius</i> L.)	184
		7.2.7	Linseed (Linum usitatissimum L.)	185
	7.3		Seeds as Medicine	185
		7.3.1	Coriander seeds (Coriandrum satium L.)	185
		7.3.2	Caraway (Cumin carvi L.)	186
		7.3.3	Pepper seeds (Piper nigrum L.)	186
		7.3.4	Cumin seeds (Cuminum cyminum L.)	186
		7.3.5	Fenugreek seeds (Trigonella foenum-graecum L.)	187
	7.4		es and Medicinal Use	187
		7.4.1	Soybeans (Glycine max (L.) Merrill)	187
		7.4.2	Mucuna pruriens L.	188
		7.4.3	Tamarind seeds (Tamaridus indica L.)	188

Contents ix

	7.5	Underutilized Seeds	189
		7.5.1 Perilla (Perilla frutescens [Hassk.])	189
		7.5.2 Hunteria umbellata ([K. Schum] Hallier f.)	189
		7.5.3 Microula sikkimensis (Hemsl.)	189
		7.5.4 Chinese chive seeds (<i>Allium tuberosum</i> Rottl.)	190
		7.5.5 Grape seeds (<i>Vitis vinifera</i> L.)	190
		7.5.6 Pumpkin seeds (<i>Cucurbita</i> sp.)	191
	_ /	7.5.7 Horse chestnut seeds (Aesculus hippocastanum L.)	192
	7.6	Future Outlook	192
		References	193
8	Effec	ets of Carotenoids and Retinoids on Immune-Mediated Chronic	
	Infla	mmation in Inflammatory Bowel Disease	213
	Hua	Zhang, Ming Fan, and Gopinadhan Paliyath	
	8.1	Introduction	213
	8.2	Carotenoids	213
	8.3	IBDs	214
	8.4	Phytochemicals and Downregulation of IBD	215
		8.4.1 Antioxidative capacity of carotenoids to reduce	
		oxidative stress generated from inflammation	215
		8.4.2 Immune-modulating activity of carotenoids	216
	8.5	Effects of Carotenoids on Immune Genetic Mechanism of IBD	221
		8.5.1 Potential role of retinoid receptors in attenuation of	
		inflammatory diseases	222
		8.5.2 Modulation of inflammatory responses through	
		activation of nuclear receptors containing	
		RXR heterodimers	223
	8.6	Effects of Retinoids and Carotenoids on the Oxidative Stress	
		Signaling Pathway	226
		References	229
9		inant Trans Fat as Potential Nutraceutical Components to	
		ent Cancer and Cardiovascular Disease	235
	Ye W	Vang, Catherine J. Field, and Spencer D. Proctor	
	9.1	Introduction	235
	9.2	c9,t11-CLA Isomer and Health Implications	237
		9.2.1 CLA modulates carcinogenesis	237
	9.3	Mechanisms of CLA Action on Cancer	245
	9.4	CLA Modulates CHD Risk Factors	245
	9.5	Mechanisms of CLA Action on CHD	246
	9.6	Vaccenic Acid	252
		9.6.1 VA modulates carcinogenesis	253
		9.6.2 VA modulates CVD risk factors	253
	9.7	Dairy Fat Enriched with VA and CLA	254
		9.7.1 Enriched dairy fat modulates carcinogenesis	254
		9.7.2 Enriched dairy fat modulates CVD risk factors	255

	9.8	Discussion References	255 256
10		technology for Cerebral Delivery of Nutraceuticals for the	
		ment of Neurodegenerative Diseases et Kaur Sahni, Sihem Doggui, Lé Dao, and Charles Ramassamy	263
	-		
	10.1	Introduction	263
	10.2 10.3	Oxidative Stress in Mild Cognitive Impairment (MCI) and AD Efficacy of Selected Components of Nutraceutical Compounds in the	264
	10.4	Amyloid Cascade and in the Prevention of AD Targeted NPs for Delivery of Bioactives Compounds from	266
		Foods for the Treatment of AD	272
		10.4.1 Catechins coupled with NPs	272
		10.4.2 NPs targeted with ApoE containing curcumin	273
		10.4.3 Resveratrol-loaded NPs protect againt $A\beta$ -induced toxicity	275
	10.5	Conclusion	275
		References	275
1	Canc	er Prevention by Polyphenols: Influence on	
		l Transduction and Gene Expression	285
	-	a Hakimuddin and Gopinadhan Paliyath	
	11.1	Introduction	285
			285
		Genetic Mechanisms of Carcinogenesis	283
	11.3	Biochemical Mechanisms of Carcinogenesis	207
		11.3.1 Pathways and signals involved in neoplastic	287
		cell transformation and carcinogenesis	287
		11.3.2 Extracellular signal transduction11.3.3 Intracellular signal transduction	289
	11.4	e	209
	11.4	Signaling Pathways in Breast Cancer 11.4.1 Calcium homeostasis and signaling	291
			292
		11.4.2 Role of calcium in regulating cell proliferation and cell cycle	293
		11.4.3 Regulation of the cell cycle by calmodulin	293
		11.4.4 Calcium signaling and cell death	293
		11.4.5 Mitochondria, calcium signaling, and apoptosis	294
	11.5	Cancer Prevention and Therapy	294
	11.5	11.5.1 Targeted therapies	294
		11.5.2 Phytochemicals and cancer prevention	296
	11.6	Grapes and Red Wine as a Dietary Source of Polyphenols	298
	11.0	11.6.1 Health benefits of red wine	298
		11.6.2 Modulation of signaling pathways by flavonoids	306
	11.7	Genetic Approach: Identification of Flavonoid Mediated	200
	11./	Molecular Targets	308
	11.8	Estrogen Metabolism, Breast Cancer, and Flavonoids	311
		Polyphenols and Estrogen Signaling	312
	11.9	POLYDREBOIS AND ESTROYED SIGNATION	<u>, 117</u>

Contents **xi**

12	and l	o–Herb Synergies as Food Designs for Hyperglycemia Hypertension Management I Saleem, Ali Hussein Eid, and Kalidas Shetty	325
	12.1	Introduction	325
		Phenolic-Enriched Chilean Potato and Select Species of	0-0
		Apiaceae and Lamiaceae Families in Diet	327
	12.3	Combination of Potato with Seeds and/or Herbs for	
		Hypertension and Hyperglycemia Management	331
		12.3.1 Chilean potato (Solanum tuberosum ssp. tubersocum L.)	331
		12.3.2 Apiaceae family	333
		12.3.3 Lamiaceae family	335
	12.4	Conclusions: Combining the Chilean Potato with Seeds and	
		Herbs from the Apiaceae and Lamiaceae Families	336
		References	338
13		entation-Based Processing of Food Botanicals for	
		lization of Phenolic Phytochemicals for Type 2	
		etes Management	341
	Chan	drakant Ankolekar and Kalidas Shetty	
	13.1	Introduction	341
		Diabetes: The Rising Burden	342
		Fermentation and Health: A Historical Perspective	342
	13.4	1	343
		13.4.1 Preservation of food through acid/alcohol formation	343
		13.4.2 Enrichment of food substrates through formation of	
		micro and macro nutrients	344
		13.4.3 Flavor, aroma, and texture development	344
		13.4.4 Detoxification of substrates during fermentation	345
	13.5	Phenolic Antioxidants and Diabetes Management	345
	13.6	Microbial Aerobic Growth and Fermentation and Its	
		Anti-Diabetes Potential by Phenolic and Antioxidant Mobilization	346
		13.6.1 Solid State Growth (SSG)	346
		13.6.2 Liquid state (submerged) fermentation	347
	13.7	Fruit Juice Fermentation for Healthy Food Ingredients for	• • •
		Management of Type 2 Diabetes	348
		13.7.1 Apple juice fermentation	348
		13.7.2 Pear juice fermentation	349
		13.7.3 Cherry juice fermentation	349
	13.8	Summary	350
		References	351
14		narvest Strategies to Enhance Bioactive Ingredients for	
		2 Diabetes Management and Heart Health	357
	Dipa	yan Sarkar and Kalidas Shetty	
	14.1	Introduction	357

Contents	xiii

	14.2	Changing Distant Dattorney A Historical Devenantice	257
	14.2	Changing Dietary Patterns: A Historical Perspective Noncommunicable Chronic Diseases: Era of New	357
	14.5		250
	144	Global Epidemics	358
	14.4	Healthy Diet: "Prevention Is Better Than Cure"	360
		14.4.1 Fruits and vegetables: from garden of eden to	
		modern horticulture	360
	14.5	e	361
	14.6	Dietary Polyphenols: Impact on Human Health	362
		14.6.1 Role of polyphenols in glucose metabolism	362
		14.6.2 Polyphenols and cardiovascular disease	364
	14.7	Phenolic Biosynthesis: Biological Mechanism to	
		Improve Dietary Polyphenols in Plant Models	365
	14.8	Postharvest Strategies to Improve Bioactive Ingredients	
		in Fruits and Vegetables	367
		14.8.1 Temperature	367
		14.8.2 Light and oxygen	368
		14.8.3 Chemical treatment and natural compounds	368
	14.9	Phenolic-Linked Antioxidant Activity During Postharvest Stages	
		in Fruits and Relevance for Type 2 Diabetes	369
	14.10	Future Direction of Research: When Functional Food and	
		Diet Become "Panacea"	370
		14.10.1 Stage 1: physiology and growth during germination to	
		maturity	370
		14.10.2 Stage 2: postharvest management	371
		14.10.3 Stage 3: food processing	371
		14.10.4 Stage 4: biotechnological tools	372
		14.10.5 Stage 5: in vitro studies	372
		14.10.6 Stage 6: animal, clinical, and epidemiological studies	372
		14.10.7 Stage 7: marketing, awareness, and education	373
	14.11	Conclusions	373
		References	373
1.7			201
15		ncing Functional Food Ingredients in Fruits and Vegetables	381
	Snalla	a Wadud and Gopinadhan Paliyath	
	15.1	Introduction	381
	15.2	Strategies for Nutritional Enhancement	382
	15.3	Improving the Mineral Content of Plant Foods	383
		15.3.1 Iron and zinc	384
	15.4	Improving the Antioxidants Content of Plant Foods	385
		15.4.1 Lycopene and β -carotene	385
		15.4.2 Vitamin E	387
		15.4.3 Flavonoids	387
	15.5	Improving the Amino Acid Content of Proteins of Plant Foods	389
	15.6	Improving the Fatty Acid Composition of Plant Seed Oil	390
	15.0	Influence of Processing and Storage in the Nutritive Value of	
	13,7	Plant Foods	391
		1 10110 1 0000	571

15.7.1	Processing of plant oils	391
15.7.2	Processing of fruits and vegetables	391
Referen	ices	392

Index