

PREFACE	ix
ABOUT THE AUTHOR	xi
ABBREVIATIONS	xiii
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 History	1
1.3 Production	2
1.4 Grain Structure	2
1.5 Chemical Composition	5
1.5.1 Starch	8
1.5.2 Dietary Fibres	8
1.5.3 Protein	10
1.5.4 Lipids	11
1.5.5 Vitamins	11
1.5.6 Minerals	12
1.5.7 Phenolic Compounds	12
1.6 Uses	13
1.7 Conclusions	13
References	14
CHAPTER 2 PHYSICAL AND FUNCTIONAL PROPERTIES	21
2.1 Introduction	21
2.2 Physical Properties	21
2.3 Milling	23
2.4 Hunter Color Characteristics	27
2.5 Functional Properties	28

2.6	Pasting Properties	30
2.7	Thermal Properties	30
2.8	Conclusions	31
	References	31

CHAPTER 3	FUNCTIONAL COMPONENTS AND ANTIOXIDANT POTENTIAL OF BARLEY	35
3.1	Introduction	35
3.2	Health Benefits of Whole-Grain Cereals	36
3.3	Mechanism of Action	36
3.4	Classification of Bioactive Compounds	38
3.4.1	Phenolic Acids	38
3.4.2	Flavonoids	38
3.4.3	Tocopherols and Tocotrienols	38
3.4.4	Others	38
3.5	Bioactive Compounds in Whole-Grain Cereals	39
3.6	Phenolic Acids	39
3.7	Flavonoids	42
3.8	Tocopherols	49
3.9	Carotenoids	50
3.10	Tannins	51
3.11	Lignans	51
3.12	Alkylresorcinols	52
3.13	Phytosterols	52
3.14	β -Glucan	53
3.15	Conclusions	53
	References	54

CHAPTER 4	β-GLUCANS: MECHANISM OF ACTION	65
4.1	Introduction	65
4.2	Extraction of β -Glucan	66
4.3	Utilization as an Ingredient	66
4.4	Mechanism of Action	68
4.5	Health Benefits	69
4.5.1	Reduction of Cholesterol	69
4.5.2	Reduction of Blood Glucose/Diabetes	70
4.5.3	Hypertension	71
4.5.4	Anti-Carcinogenic Behaviour	71
4.5.5	Body Weight Management and Obesity	72
4.5.6	Immunity	72
4.6	Conclusions	73
	References	74

CHAPTER 5	EFFECT OF PROCESSING ON NUTRITION AND ANTIOXIDANT PROPERTIES	77
5.1	Introduction	77
5.2	Processing	80
5.2.1	Dehulling/Pearling	80

5.2.2	Milling	82
5.2.3	Germination	82
5.2.4	Fermentation	84
5.2.5	Thermal Treatment	86
5.2.5.1	Extrusion	87
5.2.5.2	Roasting	88
5.2.5.3	Cooking	89
5.3	Conclusions	89
	References	90

CHAPTER 6	STARCH: STRUCTURE, PROPERTIES, AND APPLICATIONS	97
6.1	Introduction	97
6.2	Starch Isolation and Purification	97
6.3	Chemical Structure	99
6.4	Chemical Composition	100
6.5	Granular Morphology	102
6.6	Swelling Power and Solubility	105
6.7	Starch Crystallinity	106
6.8	Pasting Properties	106
6.9	Flow and Dynamic Oscillatory Analysis	109
6.10	Thermal Properties	111
6.11	<i>In Vitro</i> Digestibility	113
6.12	Applications	114
6.13	Conclusions	115
	References	115

CHAPTER 7	STARCH MODIFICATIONS: PHYSICAL, CHEMICAL, AND ENZYMATIC	123
7.1	Introduction	123
7.2	Physical Modification	124
7.2.1	Thermal Physical Modification	124
7.2.1.1	Pregelatinized	124
7.2.1.2	Hydrothermal Treatment	130
7.2.2	Nonthermal Physical Modification	131
7.2.2.1	High-Pressure Processing	132
7.2.2.2	Micronization	132
7.2.2.3	Ultrasonication	133
7.2.2.4	Pulse Electric Field	133
7.3	Chemical Modifications	134
7.3.1	Acetylation	134
7.3.2	Oxidation	135
7.3.3	Octenyl Succinic Anhydride	136
7.3.4	Acid Hydrolysis	136
7.3.5	Cross-Linking	137
7.3.6	Succinylation	137
7.3.7	Dual Modification	138
7.4	Enzymatic Modifications	139

7.5	Conclusions	140
	References	140
CHAPTER 8	MALT AND MALT PRODUCTS	149
8.1	Introduction	149
8.2	Malting Process	149
	8.2.1 Steeping/Soaking	149
	8.2.2 Germination	150
8.3	Drying	151
8.4	Malt Extracts and Syrups	152
	8.4.1 Extracts	152
	8.4.2 Syrups	153
	8.4.3 Dry diastatic malts	153
	8.4.4 Special malts	153
8.5	Malt Types	153
	8.5.1 Pale Lager Malt	153
	8.5.2 Pale Ale Malt	154
	8.5.3 Vienna Malt	154
	8.5.4 Munich Malt	154
	8.4.5 Caramel Malt	154
	8.5.6 Brown and Amber Malts	155
	8.5.7 Chocolate and Black Malts	155
8.6	Food Applications	155
	8.6.1 Bakery Goods	155
	8.6.2 Malted Milk Powder	156
	8.6.3 Beer	156
	8.6.3.1 Milling	156
	8.6.3.2 Mashing	158
	8.6.3.3 Addition of hops	159
	8.6.3.4 Fermentation/pitching	160
	8.6.3.5 Maturation	161
	8.6.3.6 Finishing, carbonation and bottling	161
	8.6.4 Malt Vinegar	161
8.7	Conclusions	161
	References	162
CHAPTER 9	PRODUCT FORMULATION	165
9.1	Introduction	165
9.2	Breads	166
9.3	Flatbreads	170
9.4	Noodles and Pastas	171
9.5	Biscuits and Cookies	173
9.6	Cakes	175
9.7	Tarhana	175
9.8	Tortillas	176
9.9	Barley Tea	176
9.10	Conclusions	177
	References	177
INDEX		183