
Contents

Foreword	ix
Acknowledgment	xi
Author	xiii
Chapter 1 Introduction, History, and Evolution	1
1.1 General Information	1
1.2 History of the Production and the Use of Lipids	2
1.3 Lipids and Human Nutrition: History and Evolution	3
1.4 Lipids and Health	6
References	7
Chapter 2 Nature and Sources of the Main Lipids	9
2.1 Introduction	9
2.2 Fatty Acids.....	11
2.2.1 Saturated Fatty Acids	11
2.2.2 Unsaturated Fatty Acids	13
2.2.2.1 <i>n</i> -9 Fatty Acids.....	13
2.2.2.2 <i>n</i> -6 Fatty Acids	13
2.2.2.3 <i>n</i> -3 Fatty Acids.....	14
2.2.3 <i>trans</i> Fatty Acids	15
2.2.4 Conjugated Linoleic Acids	16
2.3 Triacylglycerols	17
2.3.1 Crop Productions.....	18
2.3.1.1 Palm Oil.....	19
2.3.1.2 Soybean Oil	21
2.3.1.3 Rapeseed Oil.....	22
2.3.1.4 Sunflower Oil.....	23
2.3.1.5 Cottonseed Oil.....	24
2.3.1.6 Palm Kernel Oil.....	25
2.3.1.7 Peanut Oil	26
2.3.1.8 Olive Oil	26
2.3.1.9 Coconut Oil.....	27
2.3.1.10 Corn Oil.....	28
2.3.1.11 Sesame Oil.....	29
2.3.1.12 Linseed Oil	29
2.3.1.13 Processed Products: Margarines	30
2.3.2 Livestock Productions	32
2.3.2.1 Tallow	32
2.3.2.2 Lard.....	33
2.3.2.3 Butter	33

	2.3.2.4	Fish Oils.....	36
	2.3.2.5	Meat-Included Fats	37
2.4		Phospholipids.....	39
2.5		Glycolipids.....	41
2.6		Cholesterol and Phytosterols	42
2.7		Liposoluble Vitamins	43
	2.7.1	Vitamin A and Carotenoids	43
	2.7.1.1	Vitamin A	43
	2.7.1.2	β -Carotene	44
	2.7.1.3	Lutein and Zeaxanthin.....	44
	2.7.1.4	Astaxanthin.....	45
	2.7.1.5	Lycopene.....	45
	2.7.2	Vitamin D.....	45
	2.7.3	Vitamin E	47
	2.7.4	Vitamin K.....	48
2.8		Lipid Substitutes	49
	2.8.1	Low-Energy Lipids.....	49
	2.8.1.1	Structured Triglycerides	49
	2.8.1.2	Nondigestible Glycolipids.....	50
	2.8.2	Diacylglycerols	50
		References	51
Chapter 3		Lipids and Human Nutrition	53
	3.1	Introduction	53
	3.1.1	History.....	53
	3.1.2	Total Energy Requirements.....	54
	3.1.3	Nature of Dietary Lipid Intakes	56
	3.2	Metabolism and Dietary Requirements.....	59
	3.2.1	Triacylglycerols and Nutrition.....	62
	3.2.1.1	Absorption: Digestion.....	62
	3.2.1.2	Blood Transport.....	63
	3.2.1.3	Dietary Intakes of Lipids and Fatty Acids	65
	3.2.1.4	Importance of the Triacylglycerol Structure	106
	3.2.2	<i>trans</i> and Conjugated Fatty Acids	108
	3.2.2.1	<i>trans</i> Fatty Acids	109
	3.2.2.2	Conjugated Fatty Acids.....	112
	3.2.3	Cholesterol and Phytosterols	114
	3.2.3.1	Cholesterol.....	114
	3.2.3.2	Phytosterols.....	115
	3.2.4	Fat-Soluble Vitamins and Related Compounds	119
	3.2.4.1	Vitamin A and Carotenoids.....	120
	3.2.4.2	Vitamin D	127
	3.2.4.3	Vitamin E.....	138
	3.2.4.4	Vitamin K.....	143

3.2.5	Phospholipids	147
3.2.5.1	Phosphatidylcholine	147
3.2.5.2	Sphingomyelin	151
3.2.5.3	Phosphatidylserine	152
3.2.6	Glycolipids.....	153
3.2.6.1	Glycolipids Dietary Intake.....	154
3.2.6.2	Glycolipid Food Sources.....	154
3.2.6.3	Dietary Supplements.....	155
	References	155
Chapter 4	Lipids and Health	161
4.1	Introduction: Importance of Lipid Intake.....	161
4.2	Fatty Acids and Health	163
4.2.1	Saturated Fatty Acids	163
4.2.1.1	Long-Chain Saturated Fatty Acids	164
4.2.1.2	Short-Chain and Medium-Chain Fatty Acids	172
4.2.1.3	Branched-Chain Fatty Acids	174
4.2.2	<i>n</i> -9 Fatty Acids	175
4.2.2.1	Cardiovascular Disease	175
4.2.2.2	Cancers	177
4.2.3	<i>n</i> -6 Fatty Acids	178
4.2.3.1	Cardiovascular Disease	179
4.2.3.2	Cancers	180
4.2.3.3	<i>n</i> -6 to <i>n</i> -3 Fatty Acid Ratio	181
4.2.4	<i>n</i> -3 Fatty Acids	183
4.2.4.1	Cardiovascular Disease	184
4.2.4.2	Inflammatory and Immune Diseases.....	192
4.2.4.3	Metabolic Diseases	195
4.2.4.4	Cancers	197
4.2.4.5	Nervous Diseases.....	202
4.2.5	<i>trans</i> and Conjugated Fatty Acids	228
4.2.5.1	<i>trans</i> Fatty Acids	228
4.2.5.2	Conjugated Fatty Acids.....	232
4.2.6	Influence of the Structure of Triacylglycerols.....	235
4.3	Sterols and Health.....	236
4.3.1	Cholesterol.....	236
4.3.1.1	Cardiovascular Diseases	236
4.3.1.2	Nervous Diseases.....	239
4.3.1.3	Cancers	240
4.3.2	Phytosterols	241
4.4	Vitamins and Health.....	242
4.4.1	Vitamin A and Carotenoids	243
4.4.1.1	Vision	243
4.4.1.2	Immune System and Infections	246

4.4.1.3	Skin.....	248
4.4.1.4	Cancers	249
4.4.1.5	Cardiovascular System	251
4.4.1.6	Alzheimer's Disease	253
4.4.2	Vitamin D.....	254
4.4.2.1	Phosphocalcic Metabolism	255
4.4.2.2	Metabolic Diseases	256
4.4.2.3	Cardiovascular Diseases	258
4.4.2.4	Cancers	260
4.4.2.5	Nervous Diseases.....	263
4.4.2.6	Immunity	267
4.4.3	Vitamin E	272
4.4.3.1	Cardiovascular Diseases	272
4.4.3.2	Biosynthesis of Cholesterol	273
4.4.3.3	Cancers	273
4.4.3.4	Nervous Diseases.....	274
4.4.3.5	Immune System Disorders.....	277
4.4.3.6	Reproduction.....	277
4.4.4	Vitamin K.....	278
4.4.4.1	Blood Coagulation	278
4.4.4.2	Calcification (Bones and Arteries)	279
4.4.4.3	Nervous Diseases.....	281
4.5	Phospholipids.....	282
4.5.1	Phosphatidylcholine	282
4.5.1.1	Cardiovascular Disease	282
4.5.1.2	Nervous Diseases.....	283
4.5.1.3	Liver Diseases.....	283
4.5.1.4	Physical Performances.....	284
4.5.2	Phosphatidylserine.....	284
4.5.2.1	Nervous Diseases.....	285
4.5.2.2	Physical Performance	286
4.6	Sphingolipids	287
4.6.1	Nervous Diseases	287
4.6.2	Intestinal Diseases.....	289
4.6.3	Cancers.....	290
4.6.4	Biosynthesis of Cholesterol	291
4.7	Replacement Lipids	291
4.7.1	Hypoenergetic Fats.....	292
4.7.1.1	Structured Triacylglycerols.....	292
4.7.1.2	Glycolipids	293
4.7.2	Diacylglycerols	293
	References	294
	Abbreviations	303