

Contents

List of contributors	xi	Prebiotics' historical insights for enhancing poultry production	20
1. Phytobiotics and their application in poultry and aquaculture industry		Prebiotics used in laying hens and broilers' diet	21
<i>Mervat A. Abdel-Latif, Abdelwahab A. Alsenosy, Eman A. Manaa, Samar Abaza, Maryam A. Elshenawi, Asmaa Aboelnour and Mahmoud Alagawany</i>		Mode of action of prebiotics in poultry nutrition	21
Background	1	Prebiotics that help increase poultry production	22
Phenolic compounds	1	Fructo-oligosaccharides	22
Terpenes	2	Galacto-oligosaccharides	22
Alkaloids	2	Enrichment with yeasts	23
Use of phytobiotics in poultry nutrition	2	Mannan-oligosaccharides	23
Effect of phytobiotics on performance and production of poultry	2	Dietary fiber sources and indigestible carbohydrates	24
Effect of phytobiotics on blood biochemistry	3	Effects of prebiotics on avian gut physiology	24
Antioxidant and antiinflammatory action of phytobiotics	4	An investigation of the gastrointestinal tract microbiota of birds	24
Effect of phytobiotics on blood hematology	5	Prebiotics' effects on the gut's physiology and composition	25
Influence of phytobiotics on gut function and morphology	5	Effects of prebiotics on immune function and intestinal morphology	25
Effect of phytobiotics on immune response in broilers	6	Prebiotics and host nutritional benefits	26
Phytobiotics in aquaculture production	8	Nutritional aspects influencing prebiotics' effectiveness	26
Conclusion	9	Prebiotics' disadvantages related to the health and performance of birds	27
References	10	Synbiotics	27
		The role of synbiotics in physiology of digestion	28
2. Probiotics, prebiotics, and synbiotics in animal and poultry nutrition		Synbiotics' function in the development of poultry	28
<i>Mahmoud Alagawany, Mohamed I. Hegazy, Mayada R. Farag, Nahed Ahmed El-Shall, Sobhy M. Sallam and Kuldeep Dhama</i>		Conclusions	28
Background	17	References	29
What are probiotics?	17	Further reading	36
Sources of probiotics	18	3. Acidifiers and organic acids in livestock nutrition and health	
Probiotics mechanisms of action	19	<i>Ahmed E. Kholif, Gouda A. Gouda, Olurotimi A. Olafadehan, Sobhy M. Sallam and Uchenna Y. Anele</i>	
Probiotics categorization	19	Introduction	43
Probiotics' beneficial applications	19	Inorganic acids	44
Safety of probiotic strains	19	Organic acids	44
Implications and concerns	20	Chemistry of organic acids	44

Modes of action of acidifiers and organic acids	44	Effect of lipotropic factors on carcass quality	76
Role of acidifiers in nutrition	47	Poultry	76
Factors affecting the efficacy of organic acids	51	Aquaculture	77
Strategies to enhance organic acid efficacy in the gastrointestinal tract	51	Impact of dietary bile acids enrichment on the intestinal morphology and characteristics of carcass	77
Conclusions and futuristic perspective	51	Poultry	77
References	52	Effect of lipotropic factors on intestinal histopathology of poultry	78
4. Natural antioxidants in farm animals: an eco-friendly tool for improving fertility		Aquaculture	78
<i>Nesrein M. Hashem, Mahmoud Madkour, Maysara S. El-Salakawy, Doaa A. Ghareeb and Nahed Ahmed El-Shall</i>		Effect of lipotropic factors on immune response	79
Introduction	57	Poultry	79
Redox reactions and homeostasis	58	Aquaculture	79
Major classes of phytogetic antioxidants and modes of action	58	Effect of lipotropic factors on gene expression	79
Polyphenols	58	Poultry	79
Alkaloids	60	Aquaculture	80
Carotenoids	61	Effect of lipotropic factors on egg production and quality	80
Effects of phytogetic antioxidants on male fertility	61	The influence of dietary bile acids supplementation on the production and quality of eggs	80
Effects of phytogetic antioxidants on female fertility	62	Conclusion	80
New trends for manipulation of phytogetic antioxidants	63	References	80
Hazards and precautions	63	6. Bee pollen, from the flower to the harvest, and its potential therapeutic properties	
Conclusion	64	<i>Evelina Serri, Livio Galosi, Giacomo Rossi, Alessandro Di Cerbo, Alessandra Roncarati and Alessio Angorini</i>	
References	64	The function of pollen and propolis in nature	85
5. Emulsifiers and their applications in farm animals		Pollen and bees propolis	87
<i>Mahmoud Alagawany, Mayada R. Farag, Nahed Ahmed El-Shall, Faiz-ul Hassan and Mohamed E. Abd El-Hack</i>		How bees collect pollen	87
Background	69	How bees collect propolis	89
Lipotropic factors description	69	The use of propolis in the beehive	89
Effect of lipotropic factors (lecithin) growth performance	70	Quality and variety of bee pollen and propolis	90
Poultry	70	Pollen sampling technique	90
Effect of supplementing dietary bile acids on body weight changes	73	Propolis sampling technique	92
Aquaculture	73	Conservative processes	93
Effect of lipotropic factors on some blood parameters	74	Pollen	93
Poultry	74	Propolis	94
Effect of dietary bile acids supplementation on some blood biochemical changes and immune response	75	Composition	95
Aquaculture	75	Pollen	95
		Propolis	96
		Nutraceutical and curative properties of pollen and propolis	97
		Propolis	99
		Adverse effects of pollen and propolis consumption	100

Conclusion	100		
Conflict of interest statement	100		
Consent of publication	100		
Acknowledgment	100		
References	100		
Further reading	105		
7. Use of macro- and microalgae in animal nutrition			
<i>Mahmoud Madkour, Ibrahim A. Matter, Abdel Rahman Y. Abdelhady, Ahmed M. ALaqaly, Nafisa A. Abd El-Azeem and Mohamed Shafey Elsharkawy</i>			
Introduction	107		
General aspects of algae: classification, cultivation systems, harvesting	108		
Algae: macro and micro	108		
Macroalgae	108		
Microalgae	108		
Classification	109		
Macroalgae classification	109		
Microalgae classification	109		
Cultivation systems of algae	109		
Seaweeds cultivation	109		
Microalgae cultivation	110		
Open ponds (outdoor ponds)	110		
Photobioreactors	111		
Harvesting	111		
Seaweeds harvesting	111		
Microalgae harvesting	111		
Nutritional values	112		
Nutritional values of seaweeds	112		
Nutritional values of microalgae	113		
Effective materials in algae and their importance	116		
Phenolic compounds	116		
Polysaccharides	116		
Pigments	117		
Vitamins	117		
Micro- and macroelements	117		
Examples of some algae	117		
Enteromorpha prolifera	117		
Spirulina	118		
Brown seaweed	118		
Sargassum latifolium	118		
Ascophyllum nodosum	118		
Undaria pinnatifida	119		
Ulva	119		
Algae and economic aspects in animal diets	119		
Using microalgae in poultry feed	120		
Algae harmful and toxins	120		
References	121		
8. The use of bile acids supplement in poultry feed			
<i>Ayman H. Abd El-Aziz, Mahmoud M. Abo Ghanima, Mahmoud Kamal, Mohamed E. Abd El-Hack and Mahmoud Alagawany</i>			
Introduction	127		
Growth performance	129		
Carcass attributes and meat quality	131		
Hematological and biochemical parameters	131		
Intestinal morphology and health status	132		
Future perspectives	133		
Conclusion	134		
References	135		
9. Nanoclay in animal diets: properties, structure, applications, and toxicity			
<i>Amr E. El-Nile, Sobhy M. Sallam, Mohamed E. Abd El-Hack, Ayman S. Salah and Mahmoud Alagawany</i>			
Introduction	139		
Physical properties of nanoclays	140		
Structural features of nanoclays	140		
Effect of nanoclays on animal productivity	141		
Effect of nanoclays on animal health	143		
Nanoclays as a natural antibiotic	143		
Nanoclays as a mycotoxin adsorbent agent	143		
Nanoclay's toxicity	144		
Conclusion	145		
References	145		
10. Antibiotic and antimicrobial feed additives			
<i>Livio Galosi, Shakira Ghazanfar, Maliha Rashid and Alessandro Di Cerbo</i>			
Introduction	149		
Antibiotics' toxicity	150		
Antibiotics in livestock	155		
Antibiotics in aquaculture	157		
Antimicrobial feed additives in livestock	158		
Conclusion	158		
Conflict of interest statement	158		
Consent of Publication	158		
Acknowledgment	158		
References	158		
11. Methyl donors and their roles in poultry nutrition			
<i>Indrajit Kar, Ayan Mukherjee and Amlan K. Patra</i>			
Introduction	161		
Types and sources of methyl donors	161		

Methylation process and its significance in poultry	162	Yeast impact on growth performance of fish	200
Role of methyl donors in DNA methylation and gene expression regulation	163	Yeast impact on gut health of fish	202
Essential methyl donors for poultry	164	Summary	204
Methionine	164	References	204
Betaine	165		
Choline	167		
Other methyl donors in poultry nutrition	168		
Balancing methionine, choline, and betaine levels	169		
Environmental factors affecting methyl donor utilization	169		
Technological advancements and their impact on methyl donor supplementation	170		
Conclusion	170		
References	170		
12. Fibrolytic enzymes in animal and fish nutrition		14. Chelates and organic minerals	
<i>M.S. Mahesh, Hujaz Tariq and Amlan K. Patra</i>		<i>Faiz-ul Hassan, Maryam Mehboob, Rana Muhammad Bilal and Muhammad Uzair Akhtar</i>	
Introduction	175	Introduction	211
Characteristics of fiber in feedstuffs	175	The role of chelates and organic minerals in animal nutrition	211
Exogenous enzymes: types and sources	176	Mineral digestion and utilization	213
Mode of action of exogenous enzymes	178	Application of chelates and organic minerals in animal nutrition	219
Ruminants	178	Effects of minerals on milk production and composition	221
Nonruminants	179	Role of chelates in stress resistance and immune function	221
Pigs and poultry	183	Role of chelates in digestive health and gut microbiota	221
Zoo-technical responses to enzyme addition	180	Role of chelates on reproductive performance and health of animals	222
Ruminants	180	Effects of chelates on growth performance of monogastric animals	222
Effect on dry matter intake and digestibility	181	Recent applications of chelates and organic minerals for human benefits	223
Effects on lactational performance	181	Use of manganese in drug development	224
Effects on growth performance	182	Use of chelates as a promising method for food fortification	224
Other effects	182	Use of iron as chelating mineral for treatment of various diseases	224
Nonruminants	183	Chelates as antioxidants	225
Pigs and poultry	183	Role of chelates in heavy metal detoxification	225
Aquaculture	184	Conclusions	226
Economic implications	185	References	226
Practical considerations	185		
Conclusions	186		
References	186		
13. Yeast and its derivatives in animal and fish nutrition		15. Shedding light on developments in finfish nutrition	
<i>Faiz-ul Hassan, Maryam Mehboob, Rana Muhammad Bilal, Faisal Siddique and Mahmoud Alagawany</i>		<i>Norhan E. Saleh and Hany M.R. Abdel-Latif</i>	
Introduction	195	Introduction	235
Yeast as probiotics for fish	196	Applications of nutritional biotechnology in aquaculture	235
Yeast as immunostimulants for fish	198	Nutrigenomics	236
Mechanism of yeasts as immunostimulants	200	Biomarkers	236
		Epigenetics	236
		Programming the fish through nutrition	236
		Fish nutritional requirements and application of biotechnology	237
		Protein	237
		Lipids	240
		Carbohydrates	241

Vitamins and minerals	241	Applications of biotechnology in aquatic ecosystem	249
Feed additives	242	Biofloc Technology	249
Exogenous enzymes	242	Periphyton-based aquaculture Technology	249
Biopreservatives and toxin binders	243	Nanobiotechnology	250
Feed attractants	244	Nanobiotechnology in fish nutrition	250
Hormones	244	Nanoencapsulation technology for enhancing bioavailability	250
Nutraceuticals	244	Metal nanoparticle delivery through the food chain	251
Carotenoids	245	Nanotechnology applications in the fish processing industry	251
Biotechnological production of colorants	245	Funding	251
Antioxidant agents	245	Declaration of competing interest	251
Immunostimulants	246	References	251
Probiotics	246		
Prebiotics	247		
Algal constituents	247		
Applications of biotechnology in hatcheries	248		
Broodstock/egg stages	248		
Larval stages	248	Index	261
Types of microdiets and applications of biotechnology	248		