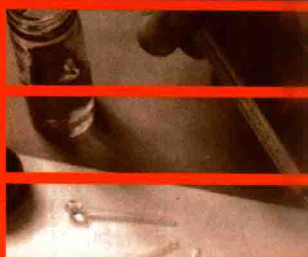


# NATURAL TOXICANTS IN FOOD



*Edited by*  
*D.H. Watson*

# Natural Toxicants in Food

Edited by

DAVID WATSON

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## **Natural Toxicants in Food**

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## Preface

This book is intended to guide readers with at least a basic understanding of chemistry through the currently important areas of work on naturally occurring toxicants in food. It covers a broader range of topics than in Watson, D. (1987) *Natural Toxicants in Food: Progress and Prospects*, Ellis Horwood. As editor, I have adopted the same general approach as was used in a book on a related subject (Watson, D. [1993] *Safety of Chemicals in Food: Chemical Contaminants*, Woodhead Publishing/Ellis Horwood).

The intended audience for this book includes scientists, technologists and managers. Since this audience is international, every effort has been made to adopt a global perspective in marshalling the facts, figures and issues. However, it is an unavoidable fact that scientific work on some natural toxicants—for example those in plants—is carried out mainly in the USA, Australasia and Europe. This has been something of a constraint in presenting a truly global picture. Nevertheless I hope that this book will encourage wider interest in natural toxicants in food. Because scientific work on natural toxicants in food can be complex, every effort has been made to spell out the main points (and abbreviations!).

I would like to emphasise that those contributing to this book are expressing their own views, not those of the organizations that employ them. My thanks go to them for all their hard work, and to my colleagues and friends for their considerable understanding whilst this book was causing me the usual birth pangs.

I hope readers find this book interesting and stimulating. It was fun to compile!

David Watson

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
	D. WATSON	
1.1	What are natural toxicants?	1
1.2	What is the effect of natural toxicants in food on us?	2
1.3	Scientific work on natural toxicants in food	2
1.4	Key examples of natural toxicants	4
1.5	Some examples of other natural toxicants in food	4
1.5.1	Psoralens	4
1.5.2	Cyanogenic and other glycosides	5
1.5.3	Bracken carcinogen	6
1.5.4	Glycoalkaloids	6
1.6	Summary	7
	References	8
	<b>The Chemistry and Toxicology of Natural Toxicants in Food</b>	<b>9</b>
<b>2</b>	<b>Pyrrolizidine alkaloids</b>	<b>11</b>
	C. CREWS	
2.1	Introduction	11
2.2	The pyrrolizidine alkaloids	11
2.2.1	Structures	12
2.2.2	Occurrence	13
2.2.3	Formation and function	14
2.2.4	Human exposure	14
2.2.5	Toxicity and metabolism	20
2.3	Conclusions	25
	References	25
<b>3</b>	<b>Glucosinolates</b>	<b>29</b>
	R. VERKERK, M. DEKKER and W. M. F. JONGEN	
3.1	Introduction	29
3.2	Chemistry	30
3.3	Biosynthesis	31
3.3.1	Amino acid formation	32
3.3.2	Aldoxime formation	32
3.3.3	Glucosylation and sulphation	33
3.4	Occurrence	33
3.5	Hydrolysis	38
3.5.1	Myrosinase	38
3.5.2	Hydrolysis products	39

3.6	Biological effects	40
3.6.1	Anticarcinogenicity	40
3.6.2	Toxicity	42
3.7	Food quality and glucosinolates	43
3.8	Responses to stress factors	44
3.9	Effects of processing	44
3.10	Analytical methods	45
3.10.1	Total glucosinolates	46
3.10.2	Individual glucosinolates	46
3.10.3	Breakdown products	47
3.11	Conclusions	48
	References	48
<b>4</b>	<b>Natural oestrogenic compounds</b>	<b>55</b>
	D. ALDRIDGE AND C. S. M. TAHOURDIN	
4.1	Introduction	55
4.2	Background	55
4.3	Occurrence of phytoestrogens	58
4.4	Measurement of phytoestrogens	61
4.5	Mycoestrogens	61
4.6	Other possible sources of plant oestrogens	70
4.7	Endogenous mammalian oestrogens in meat	70
4.8	Effects of phytoestrogens in man and animals	71
4.8.1	Exposure	71
4.8.2	Potency, oestrogen binding and other related cellular effects	72
4.8.3	Effects on reproductive function	73
4.8.4	Other effects of phytoestrogens	74
4.9	Conclusions	76
	References	76
<b>5</b>	<b>Nut allergens</b>	<b>84</b>
	F. ANGUS	
5.1	Introduction	84
5.2	Background to food allergy and intolerance	84
5.2.1	Types of reaction	84
5.2.2	Symptoms	85
5.2.3	Foods implicated	86
5.2.4	Prevalence	86
5.2.5	Family history and other risk factors	88
5.3	Peanut allergy	90
5.3.1	Botanical aspects	90
5.3.2	Major allergens	90
5.4	Tree nut allergy	92
5.4.1	Botanical aspects	92
5.4.2	Allergenicity	92
5.5	Other allergenic nuts and seeds	95
5.5.1	Coconuts	95
5.5.2	Sesame	96
5.5.3	Sunflower seed	96

5.6	Allergenicity of 'nut' oils	96
5.7	Implications of nut allergy for the food industry	98
5.8	Conclusions	100
	References	100

## 6 Bacterial toxins found in foods 105

I. MILLER, D. GRAY AND H. KAY

6.1	Introduction	105
6.2	<i>Clostridium botulinum</i>	105
6.2.1	Properties of <i>C. botulinum</i>	105
6.2.2	Types and structures of botulinum toxins	106
6.2.3	Toxicity, mode of action and effects of botulinum toxins	106
6.2.4	Incidence and occurrence of foodborne botulism	108
6.2.5	Foods and food products associated with botulism outbreaks	110
6.2.6	Food packaging techniques and the risk of botulism	113
6.2.7	Control measures	115
6.2.8	HACCP	120
6.2.9	Predictive modelling of <i>C. botulinum</i> growth and thermal inactivation	120
6.2.10	Methods for detecting botulinum toxins in foods	120
6.3	<i>Staphylococcus aureus</i>	121
6.3.1	Types and structures of <i>S. aureus</i> enterotoxins	122
6.3.2	Effects, toxicity and mode of action of <i>S. aureus</i> enterotoxins	124
6.3.3	Outbreaks of <i>S. aureus</i> food poisoning	124
6.3.4	Foods and food products associated with <i>S. aureus</i> food poisoning	126
6.3.5	Canned foods	128
6.3.6	Control measures	129
6.3.7	HACCP	131
6.3.8	Predictive modelling of <i>S. aureus</i> growth and enterotoxin production	131
6.3.9	Methods for detecting <i>S. aureus</i> enterotoxins in foods	132
6.4	<i>Bacillus cereus</i>	133
6.4.1	Properties of <i>B. cereus</i>	133
6.4.2	Types, structures and formation of <i>B. cereus</i> toxins	133
6.4.3	Effects and mode of action of <i>B. cereus</i> toxins	134
6.4.4	Occurrence of <i>B. cereus</i> food poisoning	135
6.4.5	Control measures	136
6.4.6	Destruction of preformed toxin in foods	138
6.4.7	Methods for detecting <i>B. cereus</i> toxins in foods	138
6.4.8	Other <i>Bacillus</i> species implicated in food poisoning	139
6.5	Concluding remarks	139
	References	140

## 7 Mycotoxins 147

K. A. SCUDAMORE

7.1	Introduction	147
7.2	Chemistry, toxicology and occurrence	150
7.2.1	Aflatoxins	150
7.2.2	Sterigmatocystin	155
7.2.3	Cyclopiazonic acid	156
7.2.4	Ochratoxin A	158

7.2.5	Citrinin	161
7.2.6	Patulin	162
7.2.7	Trichothecenes	164
7.2.8	Fumonisin	166
7.2.9	Zearalenone	169
7.2.10	Moniliformin	171
7.2.11	<i>Alternaria</i> toxins	172
7.2.12	Miscellaneous mycotoxins	174
References		174

## **8 Phycotoxins in seafood 182**

J. W. LEFTLEY AND F. HANNAH

8.1	Introduction	182
8.2	Causative and vector organisms	182
8.3	Paralytic shellfish poisoning	183
8.3.1	The PSP toxins	183
8.3.2	Toxic effects	188
8.4	Diarrhetic shellfish poisoning	189
8.4.1	The DSP toxins	191
8.4.2	Toxic effects	193
8.5	Ciguatera fish poisoning	194
8.5.1	The CFP toxins	196
8.5.2	Toxic effects	197
8.6	Neurotoxic shellfish poisoning	198
8.6.1	The NSP toxins: the brevetoxins	198
8.6.2	Toxic effects	199
8.7	Amnesic shellfish poisoning	199
8.7.1	The ASP toxins: domoic acid and its isomers	200
8.7.2	Toxic effects	200
8.8	Some other phycotoxins	201
8.8.1	Cyanobacterial toxins	201
8.8.2	Macrocycle lactones	201
8.8.3	Miscellaneous phycotoxins	201
8.9	Detection of phycotoxins in algae and seafood	202
8.9.1	Assays and analyses	203
8.9.2	Mammalian bioassays	203
8.9.3	Instrumental analysis	204
8.9.4	<i>In vitro</i> assays	204
8.10	Depuration of phycotoxins	207
8.10.1	Natural depuration	207
8.10.2	Depuration by cooking	208
8.10.3	The effects of freezing and chilling	210
8.11	Monitoring and regulation	211
8.11.1	Monitoring of shellfish tissues for toxicity	211
8.11.2	Phytoplankton monitoring	211
8.12	Future prospects	215
8.13	A note on the IOC harmful algal bloom programme	215
Acknowledgements		216
References		216

<b>Developing Areas of Work on Natural Toxicants in Food</b>	<b>225</b>
<b>9 The control of natural toxicants</b>	<b>227</b>
<b>A. MOORE</b>	
9.1 Introduction	227
9.2 The regulation of aflatoxins in the UK	227
9.3 Other national and international control of aflatoxins	229
9.4 Control of other mycotoxins	231
9.5 Other natural toxicants	232
9.6 Problems with legislation	233
9.7 UK regulations on inherent toxicants	234
9.8 Regulations in other countries	234
9.9 Consequences of legislation	234
9.9.1 Changes in practices	234
9.9.2 Changes to the properties of foodstuffs	234
9.10 The future of regulation in this area	235
9.11 Conclusions	235
<b>10 Quality assurance</b>	<b>236</b>
<b>R. WOOD</b>	
10.1 Introduction	236
10.1.1 European Union - Food Control Directives	236
10.1.2 Codex Alimentarius Commission	237
10.2 Accreditation	239
10.3 Internal Quality Control: harmonised guidelines for internal quality control in analytical chemistry laboratories	240
10.3.1 Basic concepts	240
10.3.2 Scope of the guidelines	241
10.3.3 Internal Quality Control and uncertainty	242
10.3.4 Recommendations in the guidelines	243
10.4 Proficiency testing	245
10.4.1 What is proficiency testing?	245
10.4.2 Why proficiency testing is important	245
10.4.3 ISO/IUPAC/AOACI harmonised protocol for proficiency testing of (chemical) analytical laboratories	246
10.5 Methods of analysis	250
10.5.1 AOAC International	251
10.5.2 The European Union	251
10.5.3 The Codex Alimentarius Commission	252
10.5.4 European Committee for Standardization (CEN)	254
10.5.5 Requirements of official bodies for methods of analysis	255
10.5.6 Collaborative trials	256
10.5.7 Assessment of the acceptability of the precision characteristics of a method of analysis	259
10.5.8 Summary of requirements for a collaborative trial	260
10.6 Recovery factors: development of an internationally agreed protocol for the use of recovery factors	260
10.6.1 Introduction	260

10.6.2	Sources of error in analytical chemistry	262
10.6.3	International guidelines	262
10.6.4	Recommendations	263
10.7	Conclusions	263
	References	264
<b>11</b>	<b>Quantifying exposure to natural toxicants in food</b>	<b>265</b>
	<b>D. R. TENNANT</b>	
11.1	Introduction	265
11.2	Risk assessment	265
11.3	Epidemiological studies	269
11.4	Novel foods and novel food ingredients	270
11.5	Using food consumption data to estimate intakes	270
11.5.1	Disappearance data	271
11.5.2	Market basket studies	271
11.5.3	Food consumption surveys of individuals	272
11.5.4	Monte Carlo analysis	274
11.5.5	Food frequency questionnaires	275
11.5.6	Duplicate diet studies	276
11.6	Some case studies	276
11.6.1	Aflatoxin and patulin intakes in Australia	276
11.6.2	Agarinate intakes from mushrooms	277
11.7	Conclusions	282
	References	282
<b>12</b>	<b>The chemical detoxification of aflatoxin-contaminated animal feed</b>	<b>285</b>
	<b>R. D. COKER</b>	
12.1	Introduction	285
12.2	Chemical detoxification	285
12.3	Ammonia detoxification	285
12.3.1	Large-scale ammoniation	286
12.3.2	Ammoniation in the developing world	286
12.3.3	Ammoniation and the nutritional quality of feed	289
12.4	Ammoniation and feed toxicity	290
12.4.1	Animal feeding trials	290
12.4.2	The chemistry of ammoniation	293
12.4.3	The toxicity of ammoniation reaction products	296
12.5	Conclusions	296
12.6	Acknowledgements	296
	References	296
	<b>Appendix: Toxicological research into the effects of some secondary fungal metabolites in food and feeds</b>	<b>299</b>
	<b>G.E. NEAL</b>	
A.1	Introduction	299
A.2	Aflatoxins	300

A.2.1	<i>In vivo</i> toxicity	300
A.2.2	Hepatitis B virus and aflatoxins	303
A.2.3	Mutational effects	305
A.2.4	Metabolic aspects	306
A.3	Ochratoxin A	310
A.3.1	<i>In vivo</i> toxicity	310
A.3.2	Metabolic aspects	314
A.4	Fumonisin	317
A.4.1	<i>In vivo</i> toxicity	317
A.4.2	Mechanisms of toxicity	319
References		320

**Index****329**

# 1 Introduction

David Watson

## 1.1 What are natural toxicants?

Surprisingly for such a large and important group of substances, there is no standard definition of natural toxicants. They are generally understood to be chemicals with potentially toxic effects on human beings as a result of their natural occurrence in food. The natural occurrence of these toxicants arises from their production by living organisms.

Natural toxicants in food can originate in plants, bacteria, algae, fungi and, arguably, animals. Taking those in plants first, they can reach our plates from the harvesting of crops that are then sold to us direct or in processed form, or are fed to food-producing animals. Farm animals can in some cases act as a biological barrier between natural toxicants in animal feed and meat-eating or milk-drinking consumers. This generally depends on whether or not the animal's own metabolism can detoxify the natural toxicant or the animal can excrete the toxicant. If neither of these processes remove the toxicant, it is likely to occur in food.

It is not generally considered that animals themselves produce natural toxicants, although some of the substances produced by animals may have effects on our health. One can rationalise this scientifically: substances in animals that might harm our health are produced by primary metabolism, i.e. the processes necessary for life. Natural toxicants in plants, fungi, algae and bacteria are produced in another way, by secondary metabolism, which gives the organism its particular characteristics. Although this difference between substances produced by animals and those formed by other living organisms is useful it really only identifies differences in the origins of two different types of natural toxicant. Nevertheless it is convention that animal metabolites are not considered to be natural toxicants. This approach is followed in this book, except in one place: there is mention of hormone-disrupting substances from food-producing animals in Chapter 4. Scientific work on these substances is crossing many traditional scientific barriers in its search to identify the main sources of exposure to hormone-disrupting substances in our diet.

The routes by which we are exposed to bacterial toxins are quite direct—these natural toxicants are generated by bacteria in food or in our gastrointestinal tracts. Bacterial toxins produced in food are reviewed in this book.

Toxicants produced by algae contaminate our food by one main route, directly up the food chain, for example from toxigenic (toxin-producing)



algae that are consumed by some filter-feeding molluscs which we in turn eat.

Of all the potential sources of natural toxicants in our diet, fungi are probably the most ubiquitous. The natural toxicants that are produced by some fungi are called mycotoxins. These toxicants can contaminate our food at virtually any stage in its production.

Research on natural toxicants in the diet is carried out across the world. For example there are extensive data in the scientific literature on the presence of some mycotoxins, particularly aflatoxins, in food in very many countries. However, much scientific work is still needed, particularly on the toxicology of many natural toxicants. For example cycasin, which is produced by cycads, a source of food starch in some parts of the tropics, appears to be both neurotoxic (toxic to the nervous system) and carcinogenic (a cause of cancer). This is one example among many where more is known about the presence in food of a natural toxicant than about whether that toxicant is actually toxic to man. This makes it difficult to define what the risk is, if any, of eating cycad starch or the many other foods across the world that contain natural toxicants of unknown potency.

## **1.2 What is the effect of natural toxicants in food on us?**

The possible effects of natural toxicants, as a group of substances, include most of the common chronic (long-term) illnesses such as cancer. It is not surprising that these effects have been suggested since they are the ones that are most commonly looked for in experimental work on the toxicity of chemicals. The difficulty is in relating information about the presence of natural toxicants in the diet to us as consumers. The objective is to determine the likely incidence of illness from exposure to known amounts of a given natural toxicant in the diet. It is less difficult to estimate exposure and hence risk for the relatively few natural toxicants, such as bacterial and algal toxins, that have fairly immediate effects on us. This is because the time between eating contaminated food and the onset of illness is relatively short, so there is more chance of finding out which food caused the illness. However, even for these toxicants it can sometimes be difficult to establish the link between cause and effect. Where an illness might have arisen as a result of consuming a particular foodstuff from time to time over a period of years, establishing the exact cause is extremely difficult.

## **1.3 Scientific work on natural toxicants in food**

A lot of scientific work has been done on a few natural toxicants and much less on others. There are several reasons for this, not least history. The idea that a natural chemical present in food or feed might cause illness was given