

# FOOD TOXICOLOGY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Hygiene, Food Safety and Food Quality Management	Food Toxicology	2nd	2nd	6	Compulsory
LECTURER(S)			Postal address, telephone n <sup>o</sup> , e-mail address		
<ol style="list-style-type: none"> <li>1. <b>LOURDES RODRIGO CONDE-SALAZAR (PTU)</b></li> <li>2. <b>ANTONIO HERNÁNDEZ JEREZ (CU)</b></li> <li>3. <b>FERNANDO GIL HERNANDEZ (CU)</b></li> <li>4. <b>ANTONIO PLA MARTÍNEZ (CU)</b></li> <li>5. <b>OLGA LOPEZ GUARNIDO</b></li> </ol>			<ul style="list-style-type: none"> <li>• Department of Legal Medicine, Toxicology and Physic Antropology Faculty of Medicine (PTS). Avenida de la Investigación, 11. 18016 - Granada. Tel: 958-243546. Fax: 958-246107 Email:</li> <li>• <a href="mailto:lourdesr@ugr.es">lourdesr@ugr.es</a></li> <li>• <a href="mailto:ajerez@ugr.es">ajerez@ugr.es</a></li> <li>• <a href="mailto:fgil@ugr.es">fgil@ugr.es</a></li> <li>• <a href="mailto:apla@ugr.es">apla@ugr.es</a></li> <li>• <a href="mailto:olga@ugr.es">olga@ugr.es</a></li> </ul>		
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT					
Degree in Human Nutrition and Dietetics					
PREREQUISITES and/or RECOMMENDATIONS (if necessary)					
No requirements					
BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE ¿??)					
<ul style="list-style-type: none"> <li>• Abiotic pollution: toxic compounds and contaminants present in food.</li> <li>• Causes toxicity: origin and prevention.</li> </ul>					



## GENERAL AND PARTICULAR ABILITIES

### A. General skills

- Understanding, critically evaluating and knowing how to use and apply information sources related to nutrition, food, lifestyle and health aspects.
- Knowing toxicology of food
- Interpreting reports and administrative records relating to a food product and ingredients.
- Intervening into the food safety and quality of products, facilities and processes
- Acquiring basic training for research activity, being able to formulate hypotheses, collect and interpret information to solve problems using the scientific method and understanding the importance and limitations of scientific thinking on health and nutrition

### B. Specific skills

- Knowing microbiology, parasitology and toxicology of food
- Scientific and technical advice on food products as well as its development. Assessing compliance with such advice.
- Collaborating on consumer protection in the context of food security

## OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

- Knowledge of the fundamentals and basic principles of toxicology.
- Understand the processes and mechanisms affecting food spoilage (chemical pollution) and how it can be prevented.
- Know the legislation related to food safety as it relates to chemical contamination of food.
- Basic knowledge of methodology on the evaluation of toxicity and risk.

## DETAILED SUBJECT SYLLABUS

### **THEORETICAL SYLLABUS:**

#### **I. BASIC/FUNDAMENTAL TOXICOLOGY**

Item 1. ORIGINS AND SCOPE OF TOXICOLOGY: Concept of Toxicology, poisoning and toxic. Historic milestones (1h)

Item 2. INTRODUCTION TO TOXICOLOGY: Forms of intoxication. General etiology of poisoning. Subdivisions of Toxicology. Food Toxicology: framework and concept (1h).

Item 3. THE TOXIC PHENOMENON: Concept of toxicity. Phases of toxic phenomenon. Factors



affecting toxicity. Chemical structure-toxicity. Dose-response relationships (1 h).

Item 4. TOXICOKINETICS (I): General: Toxicological Interest of toxicokinetics. Main routes of absorption. Absorption through the digestive tract: Toxicological aspects. (1 h).

Item 5. TOXICOKINETICS (II): Distribution and elimination of toxics. Toxicological concern of distribution and elimination of toxics (1h)

Item 6. TOXICOKINETICS (III): The metabolism as the main determinant of toxicity. Types of metabolic reactions. Factors affecting the biotransformation of toxics. Metabolism-toxicity relationships (2 h).

Item 7. MECHANISM OF ACTION OF TOXICS (I): General. Selective toxicity. Classification. (1 h)

Item 8. MECHANISM OF ACTION OF TOXIC (II): Main mechanisms of toxicity (1 h)

## **II. EVALUATION OF TOXICITY AND RISKS**

Item 9. INTRODUCTION TO THE EVALUATION OF TOXICITY AND RISKS. Concept of evaluation of toxicity and risk assessment. Fundamental principles of toxicity testing. General variables in the toxicological evaluation. Regulations of toxicity evaluation and international agencies involved. Classification of the toxicity tests (1 h)

Item 10. TOXICITY TESTS. Providing information, methods and limitations. (2 h)

Item 11. TOXICITY CRITERIA (I). Toxicity parameters obtained in the toxicological evaluation. Indices of acute, subchronic and chronic toxicity. Calculations. (1 h).

Item 12. TOXICITY CRITERIA (II). Extrapolation to humans: tolerable limits of exposure and maximum concentration allowed. Calculations and practical application (1 h).

## **III. DESCRIPTIVE TOXICOLOGY**

Item 13. NATURAL TOXIC SUBSTANCES IN FOODS (I). Main natural toxics that may be present in food. Toxicological significance. Antinutritional agents. Substances with polyvalent activity. Substances that increase catabolism. (1 h)

Item 14. NATURAL TOXIC SUBSTANCES IN FOODS (II): Toxic foods: Alkaloids. Glycosides. Xanthines. (1 h)

Item 15. NATURAL TOXIC SUBSTANCES IN FOODS (III). Xenoestrogens. Carcinogens. Favism. Lathyrism. Lectins. (1 h)



- Item 16. **TECHNOLOGICAL INGREDIENTS:** Additives and flavorings. Toxicological and food safety problems. (1 h).
- Item 17. **CHEMICAL CONTAMINATION OF FOOD.** Definition. Origin of pollution. Major chemical contaminants in food. Toxicological problems arising from chemical contamination. (1 h)
- Item 18. **AGRICULTURAL POLLUTANTS (I):** nitrates and nitrites. Origin of pollution. Toxicological problems. (1 h)
- Item 19. **AGRICULTURAL POLLUTANTS (II):** Mycotoxins: Aflatoxins. Origin of pollution. Toxicological problems. (1 h)
- Item 20. **AGRICULTURAL POLLUTANTS (III):** Mycotoxins: Fusarium toxins, ochratoxin, patulin. Origin of pollution. Toxicological problems. (1 h).
- Item 21. **TOXICS PRODUCED DURING FOOD PROCESSING (I):** Polycyclic aromatic hydrocarbons. Food contamination and toxic effects. (1 h)
- Item 22. **TOXICS PRODUCED DURING FOOD PROCESSING (II):** Heterocyclic amines. Food contamination and toxic effects. (1 h)
- Item 23. **TOXICS PRODUCED DURING FOOD PROCESSING (III):** Acrylamide. Food contamination and toxic effects. (1 h)
- Item 24. **OTHER TOXICS PRODUCED DURING FOOD PROCESSING (IV):** Food contamination and toxic effects. (1 h)
- Item 25. **PERSISTENT ORGANIC POLLUTANTS (POPs).** Dioxins. Furans. PCBs. Origin of pollution. Toxicological problems. (1 h)
- Item 26. **MATERIALS IN CONTACT WITH FOOD:** Wood, glass, ceramics, elastomers and polymeric material, metal packaging. Food contamination and toxic effects (1 h)
- Item 27. **TOXICITY OF PESTICIDE RESIDUES (I).** Pesticide residues in food. Classification. Organochlorine insecticides. Mechanism of action and major toxic effects (1 h)
- Item 28. **TOXICITY OF PESTICIDE RESIDUES (II).** Organophosphate and carbamate insecticides. Pyrethrins. Mechanism of action and major toxic effects (1 h)
- Item 29. **METAL TOXICITY (I):** Causes of food contamination by metals. Lead. Food contamination. Mechanism of action and major toxic effects. (1 h)



Item 30. METAL TOXICITY (II): Cadmium and mercury. Food contamination. Mechanism of action and major toxic effects (2 h)

Item 31. METAL TOXICITY (III): Arsenic, tin and aluminum. Food contamination. Mechanism of action and major toxic effects (1 h)

Item 32. DRUG RESIDUES IN FOODS (I). Concept of residue. Origin of drug residues in food. Types of drugs used. Tolerance level: zero tolerance, tolerance negligible and finite. Problems posed by the residues. Suspension or withdrawal time (1 h)

Item 33. DRUG RESIDUES IN FOOD (II). Toxicological significance of drug residues in food. The short and long-term effects (1 h).

### **PRACTICAL SYLLABUS:**

#### **Seminars/ Practice**

1. BIBLIOGRAPHIC RESOURCES IN FOOD TOXICOLOGY. Major databases in Food Toxicology. Making practical cases.

2. SYSTEMATIC analytical in food toxicology. Types and sample preparation in the analysis of toxic substances in food. Extraction of toxic food samples. Analytical techniques.

3. TOXICITY EVALUATION AND RISKS. Methodological issues and policy. Current situation in the European Union. Risk Assessment Methodology. Resolution of practical cases.

#### READING

#### **KEY REFERENCES:**

TOXICOLOGÍA ALIMENTARIA. Ana Cameán y Manuel Repetto (eds). Díaz de Santos. Madrid. 2006.

TRATADO DE NUTRICIÓN. Angel Gil y M.D. Ruiz López (eds.) Tomo II. Cap. 21. Ed. Panamericana. Madrid. 2010.

CASARETT & DOULL'S TOXICOLOGY. 7ª ed. C.D.Klaassen. McGraw Hill. New York. 2008.

CASARETT Y DOULL: FUNDAMENTOS DE TOXICOLOGÍA. C.D.Klaassen y J.B. Watkins.



McGraw Hill-Interamericana. Madrid. 2003.  
MEDICINA LEGAL Y TOXICOLOGÍA. 6ª ed. E. Villanueva (ed). Editorial Masson, S.A. Barcelona, 2004.  
PRINCIPLES AND METHODS IN TOXICOLOGY. □ 5ª edición. A.W. Hayes. CRC Press, New-York, 2008  
MANUAL DE TOXICOLOGÍA. Antonio Pla, Antonio F. Hernández, Fernando Gil. Editorial Avicam-Fleming. Granada, 2016.

#### **FURTHER READING:**

TOXICOLOGÍA AVANZADA. Repetto M.. Díaz de Santos, Madrid, 1995  
MANUAL DE EVALUACIÓN Y ADMINISTRACIÓN DE RIESGOS. Kolluru R, Bartell S, Pitblado R y Stricoff S. McGraw Hill, México. 1998  
TOXICOLOGÍA Y SEGURIDAD DE LOS ALIMENTOS. R. Derache. Ediciones Omega, S.A. Barcelona, 1990.  
TOXICOLOGÍA DE LOS ALIMENTOS. 2ª ed. E. Lindner. Editorial Acribia, S.A. Zaragoza.1995.  
INTRODUCCIÓN A LA TOXICOLOGÍA DE LOS ALIMENTOS. T. Shibamoto y L.F. Bjeldanes. Editorial Acribia, S.A. Zaragoza, 1996.

#### **RECOMMENDED INTERNET LINKS**

Basic Toxicology.

<http://www.ugr.es/~ajerez/project>

Laboratory Practice:

<http://www.ugr.es/~fgil/project/index.php>

Regulation about notification of new substances and classification, packaging and labeling of dangerous substances. 30.06.1998 OM. Annex B.

[http://www.consumo-inc.es/Seguridad/normativa/363\\_95/home.htm](http://www.consumo-inc.es/Seguridad/normativa/363_95/home.htm)

Spanish Food Safety Agency (AECOSAN)

<http://www.aesan.msc.es/AECOSAN>

Codex Alimentarius (FAO / WHO)

<http://www.codexalimentarius.net>

European Food Safety Authority (EFSA)

<http://www.efsa.europa.eu>

OECD ([www.oecd.org/document](http://www.oecd.org/document))

European Chemicals Bureau (<http://ecb.jrc.it/testing-methods>)



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Joint FAO / WHO Food Additives (JECFA). [http://www.fao.org/ag/agn/agns/jecfa\\_index\\_es.asp](http://www.fao.org/ag/agn/agns/jecfa_index_es.asp)

