

**COURSE DATA****Data Subject**

Code	34008
Name	Food Toxicology
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	3	Second term

Subject-matter

Degree	Subject-matter	Character
1103 - Degree in Food Science and Technology	20 - Food toxicology	Obligatory

Coordination

Name	Department
BERRADA RAMDANI, HOUDA	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.
FONT PEREZ, GUILLERMINA	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.

SUMMARY

The subject of food toxicology (34008) is a subject of mandatory third-degree course of Human Nutrition and Dietetics, which is taught in the Faculty of Pharmacy, University of Valencia. This course provides the current curriculum for a total of 6 ECTS credits are given twice a year.

The main objective of the subject of Food Toxicology is the toxicological formation with the purpose of guaranteeing to the population safe foods. For this, knowledge will be provided on several blocks: General toxicology including the phases of the toxic phenomenon, the evaluation of toxicity and risk. Food intoxications, that is, pathologies caused by natural toxins, biological contaminants, chemical pollutants as inorganic and organic, natural or synthetic and toxic derivatives. Computer and laboratory practices will be carried out where analytical methods will be applied to determine toxic concentrations in food and interpret the results obtained.



PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

To study toxicology, knowledge of a number of basic concepts of biology, physiology, chemistry and biochemistry are needed. These concepts are part of the contents of the subjects taught during the previous courses in the Graduate.

OUTCOMES

1103 - Degree in Food Science and Technology

- Manage food safety.
- Analyze and evaluate food safety risks.
- Know about toxicological risk assessment procedures.
- Prevent food poisoning by establishing toxicity safety limits in order to ensure safe food to the population.
- Know the methods most commonly used for the analysis of toxics in food.

LEARNING OUTCOMES

By undertaking this course, students should acquire the following skills and abilities:

- Basic toxicology knowledge.
- Ability to find solutions to basic toxicological problems, mainly by relating the chemical and structural properties of food contaminants.
- Presentation of database most used on toxicology, to explore toxic effects of food contaminants and their structure activities.
- Training into toxicological analysis to perform experimental work in the laboratory as introduction to a scientific and research career.

DESCRIPTION OF CONTENTS

1. General Toxicology: Toxicity and concepts

Unit 1. Food Toxicology: Introduction. Historical evolution. Bibliography.

Unit 2. Toxicological concepts. Intoxication classification. Classification of toxic substances.

Unit 3. Dose-effect relationships and dose response. Uncertainty factors



2. Phases of toxic action. Toxicokinetic. Mechanisms

Unit 4. Phases of toxic action. Exposure phase. Entrances of the toxics. Mechanisms of passage of toxics through biological membranes. Absorption.

Unit 5. Distribution, fixation and excretion of toxics.

Unit 6. Toxicokinetic phase. Compartmental models.

Unit 7. Biotransformations of toxics. Phase 1 reactions: oxidation, reduction, hydrolysis and hydration.

Unit 8. Phase 2 reactions: sulfatation, glucuronation, methylation, acetylation and conjugation with glutathione and amino acids.

Unit 9. Mechanisms of toxicity. Apoptosis and necrosis

Unit 10. Mechanisms of Non-specific toxicity and specific toxicity. Reversible and irreversible reactions.

Unit 11. Immunological mechanisms. Food allergies.

Unit 12. Factors that modify the toxicity. Factors that depend on the individual: genetic factors. Environmental factors.

3. Evaluation of the toxicity.

Procedures for toxicological evaluation. Tests of general and specific toxicity.

Chapter 13. Procedures for toxicological evaluation. Acute toxicity tests, subchronic and chronic.

Chapter 14. Carcinogenic, mutagenic, teratogenic and reproductive toxic effects. Empowerment, skin, eyes and behaviour.

Chapter 15. Alternative methods. Vitro assays. Biological substrates. Indicators of toxicity.

4. Food Toxicology

Unit 16. Marine food: Intoxications by molluscs and fish.

Unit 17. Toxics in vegetable products. Anti-nutritive substances. Superior mushrooms.

Unit 18. Toxic effects of biological contaminants. Food intoxications. Botulism, *Bacillus cereus* and *Staphylococcus aureus*.

Unit 19. Food toxin infections: salmonellosis, listeriosis, toxin infection by *Escherichia coli*, *Clostridium perfringens* toxicity and campylobacteriosis.

Unit 20. Inorganic chemical contaminants. Metals (I): Lead and mercury. Causes of food contamination by metals. Sources of exposure: lead and mercury. Mechanisms of action and toxic effects. Speciation.

Unit 21. Metals (II): arsenic, cadmium and aluminum. Mechanisms of action and main toxic effects. Speciation Food implicated as a source of exposure.

Unit 22. Toxic effects of fluorides, nitrates and nitrites.

Unit 23. Mycotoxins. Most frequent foods involved as sources of exposure.

Unit 24. Organic chemical contaminants. Pesticides: classification and toxicity.

Unit 25. Organophosphorus pesticides, carbamates and bipyridyl salts. Mechanisms of action and toxic effects. Presence in foods. Preventive measures.

Unit 26. Residues of veterinary drugs.

Unit 27. Food additives. Definition and classification.

Unit 28. Food supplements. Vitamins Minerals Other supplements. Adverse effects.

Unit 29. Toxics formed during the processing, preparation and storage of food. Pyrogenic compounds.



Non-pyrolytic compounds. Compounds formed by alkaline treatments.

Unit 30. Toxics derived from the heating and oxidation of fats and oils. Toxics formed by degradation or reaction of contaminants.

Unit 31. Food carcinogens. Diet-cancer.

Unit 32. Risk analysis. Risks evaluation. Characterization of risks. Risk management.

5. Food Toxicology practices

Good Laboratory Practice. Standard analytical food toxicology analysis. Analysis of toxic xenobiotics and as a means of quality control. Types of analysis. Toxicological analysis techniques. Evaluation of analytical data. Toxicology report

1. Safety in handling chemicals.
- 2.- Management of Databases in Toxicology
- 3.- Determination of nitrate in vegetables by visible spectrometry
- 4.- Determination of herbicides in water by liquid chromatography
- 5.- Determination of pesticides by solid phase extraction and gas chromatography.
- 6.- Determination of nitrite in meat by visible spectrometry.
- 7.- Determination of fluoride in water by potentiometer

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	9,00	0
Preparing lectures	76,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	147,00	

TEACHING METHODOLOGY

The development of the course is structured as follows:

Theoretical classes the teacher provides the student an overview of the topic, and the information necessary to understand the contents of the subject. In these classes the students themselves are encouraged to conduct the search for accessory or additional information, guiding the use of bibliographical sources needed. To monitor the class the student is recommended to review the material before the teacher leaves the virtual classroom.

Specialized tutoring sessions in groups. Be organized in small groups of students in order to guide



students and determine the functioning of the course. It will be the ideal means for students to raise questions or issues they arise throughout the development agenda.

Hands-on labs. Be conducted in small groups and attendance is mandatory. He goes step by step the student's work, to make acquire dexterity in the laboratory and determine for himself the problems that are raised. The last day of training students exposed to the group results and discuss the toxicological interpretation of them. Upon completion, must submit a notebook memory of them.

Within this block includes a practical computer, which guides the student on toxicological information search on the Internet and access to databases useful in Toxicology.

Seminars / jobs. There will be a group work on an issue raised by the teacher in order to expose the rest of the class and generate further debate. Be given in writing prior to the show a script to peers. The group is personally supervised by the teacher on a regular basis and directs the search of bibliographic sources and critical analysis of the data found in these sources. The teacher advised about the general approach of the work, so to build capacity for work, synthesis and research student

During the activities, both theoretical and practical, examples of the applications of the contents of the subject in relation to the Sustainable Development Goals (SDG), as well as in the proposals of topics for the coordinated seminars. This is intended to provide students with knowledge, skills and motivation to understand and address these SDGs, while promoting the reflection and criticism

During the activities, both theoretical and practical, examples of the applications of the contents of the subject in relation to the Sustainable Development Goals (SDG) will be indicated, as well as in the proposals of topics for the coordinated seminars. This is intended to provide students with knowledge, skills and motivation to understand and address these SDGs, while promoting reflection and criticism. Of the 17 Sustainable Development Goals, particular emphasis will be placed on the following goals related to food security:

- 1- Goal 1: End poverty in all its forms everywhere
- 2- Objective 2: Zero Hunger
- 3- Objective 3: Guarantee a healthy life and promote well-being for all at all ages.
- 4- Objective 13: Take urgent measures to combat climate change and its impacts

EVALUATION

For the evaluation of the theoretical contents, an examination of the syllabus of the subject will be carried out. The score achieved will represent 70% of the overall grade of the subject.

The practical laboratory classes will be evaluated by means of the attendance and the realization of a written exam, which will take place in the same call than the examination of the theoretical contents. At the end of the internship, the student must present a practice report that will be qualified as apt or not. The qualification of practices will represent 20% of the final grade.

The preparation and presentation of seminars will represent 10% of the final grade. The content, structure and expression of the written work will be evaluated as well as the capacity for synthesis and clarity in



the oral presentation.

The students, who do not pass the subject in the first exam, will keep the note corresponding to seminars for the July exam.

REFERENCES

Basic

- Repetto M, Repetto G. Toxicología Fundamental. 4 ed, Díaz de Santos, Madrid, 2009.
Revista del Comité Científico AECOSAN
Revista de Toxicología AETOX
- Klaassen CD, Watkins JB. Casarett y Doull fundamentos de Toxicología. Mc Graw-Hill Interamericana, Madrid (2005).
- Ballantyne B, Marrs TC, Syversen T. general and Applied Toxicology. 3rd ed. Wyley & Sons, West Sussex, 2009.

Additional

- Cameán A, M Repetto. Toxicología Alimentaria. Díaz de Santos, Madrid 2006.
- T Ballantyne B, Marrs TC, Syversen T (2009) General & Applied Toxicology. 3rd ed. Wyley & Sons, West Sussex exto referencia
- Hayes AW (2009) Principles and Methods of Toxicology. Taylor & Francis, London.
- Guía FAO/OMS para la aplicación de principios y procedimientos de análisis de riesgos en situaciones de emergencia relativas a la inocuidad de los alimentos
<http://www.aecosan.msssi.gob.es/AECOSAN/web/>
<http://www.efsa.europa.eu/es/glossary/risk-assessment>
<https://www.elika.eus/>
<https://www.eufic.org/es/>
http://acsa.gencat.cat/es/seguretat_alimentaria/avaluacio_de_riscos/
<http://www.aetox.es>
<http://www.ilsi.org/>

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Contents



The contents initially included in the teaching guide are maintained.

2. Volume of work and temporal planning of teaching

The workload for the student is maintained, derived from the number of credits, but the methodology of the activities changes with respect to the conventional teaching guide, due to the current situation that makes it necessary to adopt a hybrid teaching model.

3. Teaching methodology

- **Theoretical teaching:** it will be carried out through synchronous sessions (synchronized videoconferences on BBC, or other technology indicated by the Center) and face-to-face. The distribution of students will be done in groups, so that 50% will be in the Faculty classroom while the other 50% will go online, alternating their attendance by weeks. The class will always be held following the schedule (date and time) approved by the Center Board.
- **Tutorials:** They will all be face-to-face according to the dates set by the course calendar.
- **Coordinated or non-coordinated seminars:** They will all be face-to-face according to the dates set by the course calendar.

Practical classes: They will be face-to-face and according to the course calendar. In case of need to modify to comply with the security regulations against COVID 19, the capacity of students in the sessions could be limited to 50% establishing shifts in each group and / or testing audiovisual material prior to the student for the previous introduction of the practical part, hanging said information in the virtual classroom

If a state of total confinement took place, all face-to-face teaching would be carried out online.

4. Evaluation

If the evolution of the current pandemic allows it, it will be face-to-face and in the terms indicated in the teaching guide. Only in case this is not possible, the evaluation will be carried out through the virtual classroom with tasks or online questionnaires with single or multiple choice questions, which can be complemented with short questions and/or on certain occasions through an oral exam through video conferencing.

The relative weight of theory, practices and seminars is maintained as indicated in the teaching guide.