VNIVERSITAT DE VALÈNCIA

Course Guide
33948 Food Microbiology

COURSE DATA

Data Subject	
Code	33948
Name	Food Microbiology
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1205 - Degree in Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1205 - Degree in Human Nutrition and Dietetics	14 - Food microbiology	Obligatory

Coordination

Name	Department
HERNANDEZ RODRIGUEZ, CARMEN SARA	275 - Microbiology and Ecology
RICO VIDAL, HORTENSIA	275 - Microbiology and Ecology

SUMMARY

The subject provides the student with the basic knowledge of Microbiology, focusing learning on the applications and effects of microorganisms on food, at three levels: production, conservation and alteration. From an overview, all aspects of the biology of microorganisms are studied: taxonomy, structure, functions, genetics; as well as microbial growth control strategies.

Topics related to the unwanted effects of the presence of microorganisms in food are included, with special emphasis on aspects related to health, nutrition and food. The bases of immunology and pathogenesis are addressed, especially those of those species transmitted by food that cause infections and intoxications.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

In order to successfully address this Course, the student must master the fundamentals of subjects such as Biochemistry and Cell Biology

OUTCOMES

1205 - Degree in Human Nutrition and Dietetics

- Gain basic knowledge of the different types of microorganisms.
- Know and understand the criteria for the classification and identification of microorganisms, in particular, the differential physiological and biochemical characteristics of microorganisms of food significance.
- Differentiate between antibiotics and synthetic and semisynthetic chemotherapeutic agents and understand the importance and the genetic basis of microbial resistance to chemotherapeutic agents.
- Isolate pure cultures of microorganisms, evaluate microbial growth and work bearing in mind the aseptic technique and the concept of sterility.
- Master the techniques of cultivation, isolation and identification of microorganisms in food.
- Apply preventive measures against the transmission of foodborne microbial diseases.
- Conocer y manejar las fuentes de información básica relacionadas con la Microbiología.
- Understand the growth of microorganisms, their requirements and the methods for controlling them.
- Understand the basic mechanisms of microbial pathogenicity.
- Understand microbial genetics and the basic applications of genetic engineering in the area of food.
- Know the main sources of microbial contamination of food.
- Know about foodborne pathogenic microorganisms.
- Know and understand the epidemiology of foodborne microbial diseases.
- Know the symptoms and treatment of major diseases caused by eating food contaminated with microorganisms.

LEARNING OUTCOMES

The result of the acquisition of skills described above will be reflected in a range of abilities, competences and skills that will make the student self-reliant to:

- Develop a rationale as well as theoretical and practical arguments about the role of microorganisms in food production, in food spoilage and as source of foodborne infections and food poisoning.

- Design and carry out experiments for detection, isolation and identification of microorganisms in food.

- Understand future advancements and developments that will be occurring in the field of food microbiology.

DESCRIPTION OF CONTENTS

1. BASIC PRINCIPLES OF MICROBIOLOGY

Unit 1.- Introduction to general and food microbiology
Field of Microbiology. Microorganisms as cells. Microbial diversity. Phylogenetic relationships between living organisms. History of Food Microbiology

Unit 2.- Basic techniques in Microbiology
Handling of microorganisms in the laboratory. Sterilization and asepsis methods. Culture media. Isolation of pure cultures. Microbial growth in batch and continuous cultures. Microscopy.

Unit 3.- Microbial Cell Biology
General characteristics of eukaryotic and prokaryotic cells. The prokaryotic cell: external components of the wall, cell wall and cytoplasmic membrane. Flagella, mobility and taxis. Others superficial structures, fimbriae and pili. Contents of the cytoplasmic matrix. Ribosomes, inclusion bodies and gas vesicles. Endospores. the nucleoid.

2. BASIC PRINCIPLES OF MICROBIOLOGY

Unit 4.- Microbial metabolism: Obtaining energy
Ways of obtaining energy. Phototrophic, chemolytotrophic and chemoganotrophic microorganisms. Degradation of glucose to pyruvate. Catabolism of lipids and proteins. Fermentations: concept and characteristics.

Unit 5.- Microbial growth
Bacterial cell division. Growth of bacterial populations: the growth curve. Microbial growth measurement methods. Influence of environmental factors on growth: temperature, pH, osmotic pressure, oxygen concentration, radiation, pressure. Biofilms.

Unit 6.- Control of microbial growth.
Microbial control methods. Kinetics of microbial death. Physical control methods: heat, low temperatures, radiation, filtration. Chemical antimicrobial agents for external use. Antimicrobial chemotherapeutic agents: synthetic antibiotics and antimicrobials. Origin, mechanisms and transmission of antimicrobial drug resistance. Antifungal drugs. Antiviral drugs. Search for new antimicrobials.

3. BACTERIAL GENETICS

Unit 7.- Bacterial Genetics Basics: Genetic Organization and Mutation
Main characteristics of the DNA replication, transcription and translation processes in prokaryotes. Mutations: molecular bases, types, effects, mutagens, isolation of mutants. Genetic recombination in bacteria. Genetic exchange in prokaryotes. Plasmids: concept and types.

4. BASIS OF IMMUNOLOGY AND MICROBIAL PATHOGENESIS

Unit 8.- Human microbiota.
Microbiota and microbiome. bacterial metagenomics. Origin, composition, evolution, functions and dysbiosis of the intestinal, cutaneous, urogenital, pulmonary and ENT microbiota. Probiotics and prebiotics.

Unit 9.- Interactions of microorganisms with the human species
Beneficial interactions with humans. Harmful interactions with humans: Pathogenesis of bacterial and viral infections. Virulence. Toxins: exotoxins and endotoxins. Host defenses against infection. Microbial mechanisms to evade host defenses.

Unit 10.- Fundamentals of Immunology
Cells and organs of the immune system. Innate immune response. Adaptive immune response. Natural immunity. Artificial immunity. Diseases of the immune response. Immunology and clinical diagnostic methods.

5. MICROBIAL ROLE IN FOOD PRODUCTION, FOOD PRESERVATION, FOOD SPOILAGE AND FOODBORNE DISEASES

Unit 11.- Viruses
General properties of viruses. Viral morphology. Composition and structure of the virion. Growth and culture of viruses. Life cycle. Viroids, virusoids and prions.

Unit 12.- Microbial systematics and taxonomy
Microbial classification and nomenclature. Classical and molecular characteristics applied in taxonomy. Food infections: transmission and epidemiology. Salmonellosis. Campylobacter enteritis. Bacillary dysentery. Diarrhea due to virulent E. coli strains. Yersiniosis. Vibrio infections. Clostridium perfringens infections. Other gastroenteritis. Food poisoning. Mycotoxins. Incidence of viruses in food. Characteristics of foodborne viruses. Hepatitis A. Norwalk virus and relatives. Rotavirus.

Unit 13.- Alteration of food caused by microorganisms
Microbial ecology of food. Microbial metabolism in food. Factors that influence microbial alteration. Food analysis principle. Sampling and microbiological analysis: generalities. Indicator and index microorganisms. Total microorganism count: plate count, most probable number, reduction of dyes, etc. Microbiological examination of surfaces.

Unit 14.- Beneficial microorganisms in food

Food fermentations: dairy products, fermented vegetables, meats, cocoa and coffee, beer and wines. Natural preservatives. Biological food preservation systems.

Unit 15. 2030 Agenda for Sustainable Development, Goal 6.
Clean water and sanitation. Analysis of the impact that sanitation and hygiene problems generate on the proliferation of microorganisms transmitted through water, and indirectly by food.

6. Practicals

Session 1
- Aseptic technique for inoculation
- Simple staining
- Negative staining
- Study the influence of incubation temperature on bacterial growth
- Study of the skin flora: Demonstration of the presence of mixed populations in nature.
- Preliminary test for the detection of Escherichia coli

Session 2
- Gram stain
- Detection and count of sulphite-reducing Clostridium
- Study the effect of UV light on bacterial growth
- Study of the growth of microorganisms: Media selective, differential and enriched
- Confirmative test for the detection of E. coli

Session 3
- Catalase test
- Oxidase test
- Complementary test for the detection of E. coli
- Counting of viable organisms. Plate count technique
- Inoculation of a miniaturised system for identification of bacteria

Session 4
- Spore staining

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
Study and independent work	70,00	0
Readings supplementary material	6,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

Theory (4.56 ECTS, 114 hours):

Lectures aimed at providing the student with basic knowledge. Attendance: 38 hours; Preparation and study: 76 hours

Practical Classroom (workshops, problems) (0.44 ECTS, 11 hours):

There will be two seminars on topics provided by the teacher and related to the module. The seminars will be submitted in writing and orally presented by students. Following the oral presentation the work will be opened for discussion among students, and moderated by the teacher. Attendance is mandatory. Attendance: 2 hours; Preparation and study: 9 hours

Laboratory and Computer Sessions (0.8 ECTS, 20 hours):

They will be conducted in small groups and attendance is mandatory. Attendance: 15 hours; Preparation and study: 5 hours

Tutorial Sessions (0.08 ECTS, 2h):

They will be structured in small groups and attendance is mandatory. Students will have the opportunity to ask questions about the course, and provide answers to short questions given beforehand. Attendance: 2 hours

Examinations (0.12 ECTS, 3 hours):

Attendance: 3 hours

TOTAL: 150 hours: 60 hours of attendance, 90 hours out of class

EVALUATION

Students will be assessed on their theoretical knowledge through a test / exam representing 80% of the final grade. The minimum grade to pass the course will be 5 out of 10. **In addition, the exam must be balanced and not present serious deficiencies in concepts or important parts of the course.**

The assessment of laboratory sessions will contribute to the final grade by 10% and it is required at least to obtain a score of 5 out of 10 to pass the course. The mark for laboratory sessions will include a test / exam and the mandatory attendance.

If the student does not pass the theoretical part of the course but has passed the practical part will save the note for the next two academic years

Conducting and attendance the seminars is compulsory and its assessment will contribute to the final grade by 10%.

REFERENCES

Basic

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Additional

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