Universidad Zaragoza

Academic Year/course: 2024/25

28439 - Food Technology

Syllabus Information

Academic year: 2024/25
Subject: 28439 - Food Technology
Faculty / School: 105 - Facultad de Veterinaria
Degree: 451 - Degree in Veterinary Science
ECTS: 12.0
Year: 5
Semester: Annual
Subject type: Compulsory
Module:

1. General information

The general objective of this subject is to provide the necessary knowledge to understand the fundamentals of the composition and properties of foods, their alterations, and the conservation and transformation treatments they undergo in the food industry so that the future veterinarian can adequately develop their professional profile related to quality control and food safety. The subject consists of two blocks called "Food Technology" and "Practicum". The "Food Technology" block consists of theoretical classes, seminars and practical activities. The "Practicum" block will be taught at the Food Science and Technology Pilot Plant

These approaches and objectives are aligned with Sustainable Development Goals (SDGs) 2, 4, 5, 7, 9 and 12.

2. Learning results

In order to pass this subject, the students shall demonstrate they has acquired the following results:

1. Is able to know the main components of food and recognize the importance of sensory, nutritional and safety properties in food quality.
2. Is able to understand the microbiological and biochemical fundamentals that determine the alteration of food and the fundamentals of the methods of control of these agents (preservation systems).
3. Is able to evaluate the quality of the main raw materials of animal origin and identify the technologies used for their handling, preservation and transformation.
4. Is able to evaluate the effects that different technological operations have on raw materials of animal origin and on the quality parameters of processed foods.
5. Is capable of knowing the principles related to food processing and preservation required to design, implement and supervise food quality and safety management systems in the food industry.

3. Syllabus

Food Technology Block

THEORETICAL CLASSES

DIDACTIC UNIT I.- INTRODUCTION

Topic 1. Introduction to the subject Food Technology Food Technology in the Degree in Veterinary Medicine. Veterinary activities related to the food industry. Subject objectives, teaching methodology, syllabus and bibliography.

Topic 2. Food Science and Technology. Birth, objectives and historical development. Current situation and prospects for the future.

DIDACTIC UNIT II.- QUALITY PARAMETERS AND COMPONENTS OF FOODSTUFFS

Topic 3. Food quality parameters Definition of food. Nutritional properties: food as a source of energy, essential nutrients. Sensory properties: texture, colour, flavour, basic concepts of sensory analysis. Safety: abiotic and biotic agents. Shelf life and expiration date.

Topic 4. Water Content and distribution of water in food. Physical and chemical properties. Interactions of water with each other and with other food components. Concept of water activity.

Topic 5. Carbohydrates Content and distribution of carbohydrates in foods. Monosaccharides and oligosaccharides: properties of interest in food. Polysaccharides: main polysaccharides of interest in food, functional properties.

Topic 6. Lipids. Content and distribution of lipids in foods. Sensory, nutritional and functional properties of major interest in Food Technology

Topic 7. Proteins. Protein content and distribution in food. Sensory, nutritional and functional properties of major interest in Food Technology.

Topic 8. Vitamins and minerals. Content and distribution in food. General causes of vitamin and mineral losses during food processing. Enrichment, restitution and fortification.

Topic 9. Food dispersions. Importance of physical structure in food characteristics. Characteristics of dispersed systems: gels, emulsions and foams.

Topic 10. Food additives. Definition. Classification. Properties of the main groups of food additives. Applications.

DIDACTIC UNIT III. FOOD SPOILAGE AGENTS

Topic 11. Physical and chemical agents. Physical agents of food spoilage: importance. Chemical alteration reactions. Lipid rancidity: factors that determine the rate of alteration. Non-enzymatic browning: factors that determine the speed of alteration.

Topic 12. Biological agents I: enzymes. Endogenous enzymes. Enzymes of microbial origin. Factors that determine the speed of alteration.

Topic 13. Biological agents II: microorganisms. Sources of food contamination. Factors influencing the growth and survival of microorganisms in food. Most important microbial groups in food: microorganisms of sanitary interest, spoilage microorganisms and microorganisms of technological interest

DIDACTIC UNIT IV. FOOD PRESERVATION PROCESSES

Topic 14. General strategies for food preservation. Preservation by separation of microorganisms, by inhibition or reduction of microbial growth and/or enzymatic activity and speed of chemical reactions, and by microbial and enzymatic inactivation.

Topic 15. Conservation by lowering the temperature: fundamentals. Introduction. Effect of low temperatures on food properties and on microbial survival and development and on the rate of chemical and enzymatic reactions. Main cold production systems.

Topic 16. Refrigeration. Introduction. Refrigeration applications in the food industry. Refrigeration storage parameters. Refrigerated warehouses and transport of refrigerated products.

Topic 17. Freezing. Introduction. Ice crystal formation, nucleation and crystal growth. Freezing curves. Effect of freezing temperatures on food properties, microbial survival and growth, and rate of chemical and enzymatic reactions. Cold burns, recrystallizations. Equipment, storage and transport of frozen products. Thawing: problems.

Topic 18. Conservation by modification of the atmosphere. Vacuum storage in controlled and modified atmospheres. Main characteristics and functions of the gases used. Effects on contaminating flora and on food characteristics. Applications in the food industry.

Topic 19. Conservation by decreasing water activity: basics. Introduction. Sorption isotherms. Water/air interactions: relative humidity in equilibrium. Psychrometric diagrams. Water activity measurement methods. Influence of water activity on microbial growth, enzyme activity and chemical alteration reactions.

Topic 20. Dehydration and lyophilization. Dehydration: kinetics and mechanism of the process. Effect of dehydration on food characteristics. Alterations of dehydrated products. Reconstitution of dehydrated foods. Facilities. Freeze-drying: fundamentals and parameters influencing the process, effect on food characteristics and alterations of freeze-dried products. Facilities.

Topic 21. Evaporation and other concentration methods. Evaporation: fundamentals and parameters influencing the process. Applications and installations. Concentration by freezing and membrane processes. Other methods based on the decrease of water activity: osmotic dehydration and addition of solutes.

Topic 22. Chemical preservation. Effect of preservatives on microorganisms: spectrum of action. Main preservatives used and applications. Antimicrobial agents of natural origin: microbial, animal and vegetable. Smoked. Composition and properties of smoke. Mechanism of action. Technological aspects. Antioxidants.

Topic 23. Conservation by acidification and fermentation. Effect of pH on microorganisms and on the rate of enzymatic and chemical reactions. Lowering of pH in food: natural and artificial acidification. Effect of acidification on food characteristics. Fermentation: characteristics of microorganisms used in food fermentation. Types of fermentations. Applications.

Topic 24. Heat preservation: fundamentals. Introduction. Kinetics of microbial and enzymatic inactivation by heat. Survival graph: D-value. Thermodestruction graph: Z-value. factors influencing the heat resistance of microorganisms and enzymes. Microorganisms and enzymes relevant to food preservation by heat.

Topic 25. Evaluation of a heat treatment. Concept of risk: commercial risk and health risk. Botulinum cooking. TDT graph: Ftz value. Effect of heat on the organoleptic characteristics and nutritional value of foods: Ctz value. Heat penetration graph.

Topic 26. Pasteurization and blanching. Blanching: objectives, applications, equipment in the food industry. Pasteurization: objectives, applications, equipment in the food industry.

Topic 27. Sterilization. Sterilization: objectives, applications, equipment in the food industry. Causes of alteration of heat-treated products.

Topic 28. New conservation technologies. New microbial inactivation systems: ionizing radiation, high pressures, high voltage electrical pulses, light pulses, ultrasound. Conservation by combined processes

Topic 29. Food packaging. Basic concepts. Packaging functions. Packaging materials: paper, cardboard, metal, glass, plastic, composite films, edible films. Types of packaging. Interactions between the container and the food. Active packaging. Filling and closing of containers. Aseptic packaging.

DIDACTIC UNIT V. MEAT AND MEAT PRODUCTS

Topic 30. Transformation of muscle into meat. Composition and nutritional value of meat. Muscle structure and ultrastructure. Development of rigor mortis. PSE and DFD meats. Meat maturation. Meat characteristics: colour, aroma and flavour, texture and toughness and water holding capacity.

Topic 31. Fresh meat technology. Obtaining the meat. Classification, cutting and categorization of meat. Preservation and marketing of fresh meat; packaging.

Topic 32. Meat products: introduction. Meat products: classification. Conservation methods. Microbiological aspects and biochemical changes. Meat additives.

Topic 33. Fresh and cured raw meat products. Main fresh and cured raw meat products. Elaboration processes, defects and alterations.

Topic 34. Cooked meat products. Main cooked meat products. Elaboration process, defects and alterations.

Topic 35. Whole raw cured meat products. Main raw whole cured meat products. Process of elaboration of hams and similar products, defects and alterations.

DIDACTIC UNIT VI FISH, FISH BY-PRODUCTS, EGGS AND EGG PRODUCTS

Topic 36. Composition, structure, post-mortem changes of fish Introduction Composition and nutritional value. Classification of fish according to its composition. Structure of fish muscle. Post-mortem changes. Determination of the degree of freshness. Influence of the fishing method and refrigeration system on the quality of fresh fish. Main species of industrial interest.

Topic 37. Fish preservation and processing methods. Preservation methods: refrigeration, freezing, drying, salting, smoking, pickling, canning and semi-preserving. Processing technology of the main fish and shellfish species of industrial interest. Frozen species: hake, cephalopods, crustaceans. Salted species: cod. Canned species: sardines and tuna. Semi-preserved: anchovies. Purified species: crustaceans, mussels. Elaboration of surimi and derivatives.

Topic 38. Egg and egg product technology. Introduction. Formation and structure. Chemical composition and nutritional value. Egg microbiology. Conservation of shell eggs. Egg products: pasteurization. Refrigerated, frozen, concentrated and dehydrated eggs.

DIDACTIC UNIT VII MILK AND DAIRY PRODUCTS

Topic 39. Milk characteristics. Composition, structure and physicochemical properties of milk. The fat globule: composition and structure. Milk carbohydrates: lactose. Casein micelle: composition, structure, acid and enzymatic coagulation. Whey proteins. Other components: vitamins, salts and minerals. Physicochemical properties: density, pH, acidity, cryoscopic point. Milk microbiology: altering and pathogenic microorganisms.

Topic 40. Milks for consumption. Milks for consumption: Obtaining, transporting, receiving and control of milk in the dairy industry. Operations prior to heat treatment. Pasteurized milk and sterilized milks, process technology and effects on milk properties. Concentrated milks: evaporated and condensed milk. Powdered milk.

Topic 41. Fermented milks. Fermented milks: yogurt, production process. Other fermented milks.

Topic 42. Cheese. General types of cheese. Elaboration stages. Acid and enzymatic coagulation. Drainage. Maturation. Melted cheese.

Topic 43. Cream, butter and ice cream. Cream: obtaining and processing cream. Butter: production process and types. Ice cream: production process.

DIDACTIC UNIT VIII. OTHER ASPECTS RELATED TO THE FOOD INDUSTRY

Ready-to-eat foods. Types. Technologies used for its production and preservation. Problems with this type of products.

Topic 45.- Collective catering Kitchen organization. Main food processing systems used in mass catering.

Planning of a food industry. Plant design: plant characteristics, layout, auxiliary facilities. Process control.

Water supply and waste treatment in the food industry. Water uses in the food industry. Water quality. Purification systems. Characteristics of food industry wastes: biological oxygen demand (BOD), chemical oxygen demand (COD) and dissolved solids. Waste treatment methods: physical, chemical and biological methods.

PRACTICAL CLASSES

Practical 1.- Measurement sensors useful for the control of food quality and safety. To know and properly handle the main measurement sensors useful for the control of food quality and safety.

Practice 2.- Predictive microbiology. Computational tools and network resources in predictive microbiology to illustrate the influence of the main factors affecting the growth and survival of microorganisms.

Practice 3.- The CTA Pilot Plant. Organization of a food processing plant. Identify the equipment used by the food industry for food preservation and processing. Understand the operation of some of them.

Practice 4.-Meat technology. Main physical-chemical and microbiological analyses for quality control of meat and meat products.

Practice 5.-Milk technology. Main physicochemical and microbiological analyses for quality control of milk and dairy products.

SEMINARS

Seminar 1.- Kinetics of microbial inactivation by heat. Elaboration of survival and thermo-destruction graphs and calculation of Dt and z parameters.

Seminar 2.- Calculation of heat treatments. Total calculation of the F0 parameter and calculation and description of the "botulinum cooking" concept.

Seminar 3.- Case. Activity in which the teacher will present a professional situation related to thermal food preservation processes. Students will have to obtain the heat penetration graph, interpret it and learn how to adjust the heat treatment for that specific product.

Seminar 3 Meat and meat products. A current topic related to the meat sector will be presented and discussed.

Seminar 4 Milk and milk products. A current topic related to the dairy sector will be presented and discussed.

Practicum Block

The activities related to this block will be carried out entirely at the CTA Pilot Plant, with the exception of the preparatory seminars (two). The aim is for students, divided into small groups, to carry out all the necessary steps for the preparation of a food, its microbiological, physical-chemical and sensory analysis and the prediction of its shelf life. They shall also design, and ensure the implementation and maintenance of, good hygienic practices to be followed during the food manufacturing process. The foods to be worked with have been chosen taking into account the theoretical program and the facilities available in the pilot

plant, and will include dairy products (yogurt, fresh cheese, other dairy products) and meat products (Frankfurt type sausages, fresh sausages, Chorizo, sausages, Chistorra, pâté...)

4. Academic activities

Food Technology Block

This block consists of 100 hours of face-to-face activities structured in 70 hours of lectures, 20 hours of practical classes in the laboratory, computer room and pilot plant and 10 hours of seminars.

Practicum Block

This block consists of 20 hours of face-to-face activities that are structured in 2 hours of preparatory seminars, 16 hours of practical classes in pilot plant and 2 hours of attendance to project presentations.

5. Assessment system

Food Technology Block (80% final grade)

Written evaluation test: There will be two midterm exams.

The first midterm exam (80% of the grade for the Food Technology block) will take place after the completion of didactic units 1, 2, 3, 4, 5 and 6, and will consist of 3 parts:

-40 multiple-choice questions corresponding to didactic units 1, 2, 3 and 4 (60% of the grade of this midterm exam).

-20 multiple-choice questions corresponding to didactic units 5 and 6 (30% of the grade of this midterm exam).

-2 questions based on the resolution of practical cases and/or the practical activities or seminars (10% grade of this midterm exam).

In order to pass the first midterm exam and eliminate some of the topics, it will be necessary to obtain a minimum grade of 6 out of 10 in each of the three parts.

The second midterm exam (20% of the grade for the Food Technology block) will be held at the same time as the final exam and will include didactic units 7 and 8 and will consist of 15 multiple-choice questions.

Students who have not passed the first midterm exam must take the two midterm exams in the final exam. In the final exam, a minimum grade of 4 out of 10 must be obtained in the 4 evaluation activities and the weighted average of these must be equal to or higher than 5.

In the multiple-choice questions, 0.25 point will be subtracted for each question answered incorrectly. Clarity and conciseness in the resolution of practical cases will be valued.

Practicum Block (20% final grade)

Teamwork: Preparation, presentation and defence of a report on the activities carried out in the Practicum. Clarity and conciseness in the production of the practical work report and oral presentation will be valued. A minimum grade of 5 out of 10 must be obtained in this test.

In case of not passing this assessment test, in order to pass the subject the student must pass, in addition to the final exam of the Food Technology Block, a test consisting of 4 development questions related to the activities carried out in the Practicum.

The grades of the tests passed during the term will be maintained in the rest of the calls of the corresponding academic year.

6. Sustainable Development Goals

2 - Zero Hunger
4 - Quality Education
12 - Responsible Production and Consumption