

28439 - Food Technology

Syllabus Information

Academic Year: 2022/23

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

1.1. Aims of the course

Among the functions assigned to veterinarians in society, it is worth highlighting their role as guarantors of Public Health through the control of hygiene and inspection in the processes of obtaining, transforming and distributing food, especially of animal origin, until it reaches the consumer. The module called "Hygiene, Technology and Food Safety" aims, among others, to train future graduates for this professional profile. This module consists of two subjects: "Food Technology" and "Hygiene, Food Inspection and Control". In turn, each of these subjects consists of two blocks: one whose name corresponds to the subject and another called Practicum.

The general goal of the Food Technology block is to provide knowledge on the composition and quality parameters of food and on the fundamentals of the processes of alteration, conservation and processing of food of animal origin required to train future graduates to perform functions related to food inspection and quality control and food safety.

The Practicum intends that future graduates understand, in addition to the influence of raw material characteristics and processing parameters on sensory quality, nutritional quality and food safety, the usefulness of carrying out food safety management applying a preventive approach as opposed to the traditional system based on the inspection and sampling of the final product. In addition, this activity will enable future graduates to adequately supervise good hygiene practices. In order to achieve this objective effectively, part of the Practicum will be taught together with the subject "Hygiene, inspection and food control", if the students are enrolled in both subjects, as recommended.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the UN 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), so that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to its achievement:

Objective 2: Zero hunger

Objective 4: Quality education

Objective 5: Gender equality

Objective 7: Clean and affordable energy.

Objective 9: Industry, innovation and infrastructure.

Objective 12: Responsible production and consumption.

1.2. Context and importance of this course in the degree

The mission of the veterinarian in our society is not just to prevent and heal animal diseases or to improve the productive performance of livestock farms. Besides, another remarkable veterinarian's role is to guarantee Public Health through the control of hygiene and inspection in the processes of obtaining, transforming and distributing food, especially of animal origin, until it reaches the consumer. It is not only necessary to have knowledge of the main technological processes involved in the production of food of animal origin in order, but also to understand the fundamentals of properties, alterations and treatments for food preservation and transformation.

1.3. Recommendations to take this course

In addition to the knowledge provided by the common basic training module, in order to take this subject, it is recommended

to have previously taken the subjects of Animal Physiology, Microbiology and Immunology and Agronomy; and the part related to animal production of the integrations in ruminants, pigs, birds and rabbits and aquatic animals. Also, the first joint registration should be done together with the subject of Hygiene, Inspection and Food Control.

2. Learning goals

2.1. Competences

On successful completion of this course, students will be able to:

- Know and interpret the fundamentals of the processes of the food processing industry of animal origin.
- Design, implement and oversee the quality management systems used by the food industry
- To advise food processing companies of animal origin on aspects related to food safety.
- Analyze, synthesize and solve problems and make decisions in professional areas.
- Improve communication, argumentation and negotiation skills.

2.2. Learning goals

If students complete the course successfully, they should be able to:

- Know the main components of food and recognize the importance of sensory, nutritional and safety properties in food quality.
- Understand the microbiological and biochemical fundamentals that determine the alteration of foods and the fundamentals of methods of control of these agents (preservation systems).
- Capable of assessing the quality of the main raw materials of animal origin and identifying the technologies used for their handling, conservation and transformation.
- Capable of evaluating the effects that the different technological operations have on the raw materials of animal origin and on the quality parameters of the processed foods.
- Know the principles related to food processing and preservation required to design, implement and supervise food quality and safety management systems in the food industry

2.3. Importance of learning goals

Students are confronted for the first time with the study of food so the skills that form this subject are relevant to contribute to the training of future graduates in the performance of the professional profile Food Safety, Technology and Quality. This function is one of the most important among those performed by the veterinarian, given its importance from the point of view of Public Health. The adequate development of these functions requires knowing the agents responsible for the alteration of food quality parameters, the strategies used by the food industry to fight against these agents and the procedures used by the food industry for the processing, storage and circulation of animal food products or products of animal origin. It is also essential to know, know how to apply and supervise the mechanisms and procedures of the quality management systems applied in the food industry.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that has achieved the intended learning outcomes through the following assessment activities

Food Technology Block (80% final qualification)

- **Written assessment test:** There will be two partial exams. The first, which will be eliminatory of the subject, will be carried out once the didactic units I, II, III and IV and V and VI have been completed and will consist of 60 test questions (90% grade, 40 questions for units I, II, III and IV and 20 for units V and VI), and 2 questions based on the resolution of practical cases and/or those in practical activities or seminars (10% qualification). The second partial exam which will consist of 15 test questions will be held, coinciding with the final exam and will include teaching units VII and VIII. Students who take the final exam must take both parts while those who have passed the first part should only perform the second partial. The qualification of the first part will be 80% and the second part 20% of the final qualification of the Food Technology block.

Practicum Block (20% final grade)

Teamwork Preparation, presentation and advocacy of a report on the process of elaboration of the food obtained in the practicum

Assessment criteria and levels of requirement

In order to pass the first partial examination and eliminate the subject, it will be necessary to obtain a minimum score of 6 out

of 10 in each of the three tests of which it consists (Block I to IV test questions, block V and VI test questions and practical assumptions questions). In the global examination, a minimum score of 4 out of 10 must be obtained in each activity and the weighted average of the four tests must be equal to or greater than 5.

In the multiple-choice questions, 0.25 points will be subtracted for each wrong answer. Clarity and conciseness in short question answers, resolution of practical cases and the elaboration of the report of the practical work and oral presentation will be assessed. The grades of the tests passed throughout the course will be kept during the rest of the seasons of the corresponding academic year. In the final assessment of June, if students have not passed the first midterm exam, they will either have to take the first midterm exam or the global assessment.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

Food Technology

This part consists of 100 hours divided in 70 hours for lectures in classroom, 20 hours for laboratory and 10 hours for seminars.

Student will have in advance the contents of the corresponding lectures. Professor will focus his presentation in those aspects harder to understand. Student should have read the material supplied in advance in order to formulate questions to the professor

Laboratory activities will consist in 5 sessions of 4 hours. The main objective of laboratory activities is to show and demonstrate different issues previously explained in the lectures.

Seminars will be attended by a smaller number of students than lectures. In this activity practical cases will be presented to be solved by students with the support of the professor and some person working in the food industry will be invited to do a presentation.

Practicum in Food Technology

This block consists of 20 hours of face-to-face activities that are structured into 2 hours of preparatory seminars, 16 hours of practical classes in pilot plant and 2 hours of attendance to the presentation of the projects prepared by the colleagues. In this part, it will be simulated in the pilot plant that students are in a food company and they will have to conduct all the steps required for the elaboration of a specific food: quality control of the raw material, elaboration of the foods, control of the final products. These activities will be conducted in coordination with the course: Hygiene, inspection and food control? and it will also develop the good hygienic practices for the corresponding food elaborated during this activity.

4.2. Learning tasks

Hours for lectures in classroom, hours for laboratory and hours for seminars.

4.3. Syllabus

UNIT I.- INTRODUCTION (2H)

Lesson1. Introduction. Food Technology in Veterinary degree. Activities of a veterinarian in the food industry. Course objectives, teaching methodology, contents and bibliography.

Lesson 2. Food Science and Technology. Origin, objectives and historic evolution. Current situation and future prospects.

UNIT II.- QUALITY PARAMETERS AND FOOD COMPONENTS (8H)

Lesson 3. Quality parameters of foods. Food definition. Nutritional properties: Energy supplied by foods, essential nutrients. Sensory properties: texture, colour, flavour, Sensory analysis. Food safety: Abiotic and biotic agents. Shelf-life and caducity.

Lesson 4. Water. Content and distribution of water in foods. Physical and chemical properties. Water interactions with foods. Water activity concept.

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

Lesson 6. Lipids. Content and distribution of lipids in foods. Sensory, nutritional and functional properties of lipids.

Lesson 7. Proteins. Content and distribution of proteins in foods. Sensory, nutritional and functional properties of proteins.

Lesson 8. Vitamins y minerals. Content and distribution in foods. Losses of vitamins and minerals during food processing.

Lesson 9. Disperse systems. Importance of the physical structure in food properties. Disperse systems: gels, emulsions y foams.

Lesson 10. Additives. Definition. Classification. Properties of the main groups of food additives. Applications.

UNIT III. FOOD SPOILING (5H)

Lesson 11. Physical and chemical agents. Physical agents. Chemical reactions. Lipid oxidation: factors affecting velocity of lipid oxidations. Non-enzymatic browning: factors affecting velocity of non-enzymatic browning.

Lesson 12. Biotic agents I: Enzymes. Endogenous enzymes. Microbial enzymes. Factors affecting enzymatic spoiling.

Lesson 13. Biotic agents II: microorganisms. Microbial contamination of foods. Factors affecting grown and survival of

microorganisms in foods. Microbial groups: Pathogenic microorganism, spoiling microorganisms.

UNIT IV. FOOD PRESERVATION (19H)

Lesson 14. Main strategies for food preservation. Preservation by eliminating microorganisms from foods. Preservation by reducing microbial activity and enzymatic reactions. Preservation by microbial and enzymatic inactivation.

Lesson 15. Food preservation by low temperatures: principles. Introduction. Effect of low temperatures on food properties. Effect of low temperatures on microorganisms, enzymes and chemical reactions. Cold generation systems.

Lesson 16. Refrigeration. Introduction. Applications of the refrigeration in the food industry. Control parameters in cold storage. Refrigerated warehouse and transportation at low temperatures.

Lesson 17. Freezing. Introduction. Ice crystals formation, nucleation and crystal growth. Freezing curve. Effect of freezing on food properties, microorganisms and microbial and enzymatic reactions. Frostbite, recrystallization. Frozen storage. Unfreeze.

Lesson 18. Food preservation by atmosphere modification. Vacuum package, controlled atmosphere and modified atmosphere. Properties and characteristics of used gases. Effect on microorganism and food properties. Applications in the food industry.

Lesson 19. Food preservation by reducing water activity: Principles. Introduction. Sorption isotherms. Interactions water/air: Relative humidity in equilibrium. Psychrometric chart. Procedures to measure water activity. Influence of water activity on microbial growth, enzymatic reactions and chemical reactions.

Lesson 20. Dehydration and lyophilisation. Dehydration: Kinetics and mechanism. Effect of dehydration on food properties. Changes in dehydrated foods. Reconstitution of dehydrated foods. Facilities. Lyophilisation: Principles and parameters affecting food lyophilisation, effect of food properties and alteration of freeze dried goods. Facilities.

Lesson 21. Evaporation and other methods of food concentration. Evaporation: principles and parameters affecting the process. Applications and facilities. Concentration by freezing and using membranes. Osmotic dehydration.

Lesson 22. Food preservatives. Effect of preservatives on microorganisms. Main preservatives and applications. Food preservatives of animal origin: from animals, from plants and from microorganisms. Smoking: composition and properties of smoke. Antioxidants.

Lesson 23. Preservation by low pH and fermentation. Effect of pH on microbial growth, chemical and enzymatic reactions. Decrease of pH in foods: natural and artificial acidification. Fermentation: characteristics of microorganisms used in food fermentations. Types of fermentations: Applications.

Lesson 24. Food preservation by heating: principles. Introduction. Kinetics of microbial and enzymatic inactivation by heat. Survival curve. Dt value. Thermodestruction curve: Z value. Factors affecting microbial and enzymatic resistance to heat. Microorganisms and enzymes of interest in food preservation by heating

Lesson 25. Fitting a heat treatment. Risk concept: commercial risk and sanitary risk. Botulinum cook. TDT curve: Ftz value. Effect of heat on sensory and nutritional value of foods: Ctz value.

Lesson 26. Pasteurization and blanching. Blanching: objectives, application, and facilities. Pasteurization: objectives, application, facilities.

Lesson 27. Sterilization. Sterilization: objectives, application, facilities. Alterations of foods treated by heat.

Lesson 28. New technologies for food preservation. New systems for microbial inactivation: ionizing irradiation, high hydrostatic pressure, pulsed electric fields, light pulses, ultrasound. Food preservation by combined process.

Lesson 29. Food packaging. Principles. Functions of packaging. Materials: paper, cardboard, metal, glass, plastic, mix films, edible films. Types of packages. Interaction package-food. Active packaging. Aseptic packaging.

UNIT V. MEAT AND MEAT PRODUCTS (12H)

Lesson 30. The conversion of muscle to meat. Meat composition and nutritional value. Muscle structure and ultra-structure. Rigor Mortis. PSE y DFD meats. Meat aging. Meat Quality Parameters: colour, odour, flavour, texture and water holding capacity.

Lesson 31. Fresh meat technology. Meat categories, dressing and cutting. Fresh meat preservation and commercialization.

Lesson 32. Meat products. introduction, classification. Preservation methods. Microbial and biochemical changes. Additives for meat products.

Lesson 33. Fresh and dry-cured meat products. Production processes and most important alterations.

Lesson 34. Cooked meat products. Production processes and most important alterations.

Lesson 35. Dry-cured products. Dry-ham elaboration processes and most important alterations. Other dry-cured products.

UNIT VI FISH, FISH PRODUCTS, FISH EGGS, EGGS AND EGGS-PRODUCTS. (7H)

Lesson 36. Fish composition, structure and post-mortem changes: Introduction. Composition and nutritional value of fish. Classification of fish. Fish muscle structure. Post-mortem changes of fish. Freshness assessment of fish. Influence of fishing methods and refrigeration systems on fish quality. Most consumed species.

Lesson 37. Fish processing and preservation. Preservation methods: refrigeration, freezing, drying, salting, smoking, marinating, canning. Fresh processing of the most consumed fish species. Frozen fish: hake, cephalopods, crustaceans.

Salted fish: cod. Canned fish: sardines and tuna. Semi preserved products: anchovies. Surimi and surimi based products.

Lesson 38. Technology of eggs and egg products. Introduction. Formation and structure. Chemical composition and nutritive value. Egg microbiology. Egg preservation. Egg products: pasteurization, refrigeration, freezing, concentration and drying.

UNIT VII MILK AND MILK PRODUCTS (12H)

Lesson 39. Properties of milk. Composition, structure and physico-chemical properties of milk. Fat globule: structure and composition, Milk carbohydrates: lactose. Casein micelles: composition and structure. Acidic and enzymatic coagulation. Whey proteins. Other constituents: vitamins and minerals. Physico-chemical properties of milk: density, pH acidity, crioscopic point. Dairy microbiology: pathogens and spoiling microorganisms.

Lesson 40. Liquid milks. Obtention, handling, transport and milk control in the dairy processing Factory. Preliminary operations. Heat treatment: pasteurized and sterilized milks: technology and effects on milk properties. Concentrated milks: evaporated and condensed milk. Milk powder.

Lesson 41. Fermented milks: yogurt elaboration. Other fermented milks.

Lesson 42. Cheese. General cheese types. Cheese manufacture. Acidic and enzymatic coagulation. Draining. Cheese ripening. Processed cheese.

Lesson 43. Cream, butter and ice cream. Cream processing. Butter manufacture and types. Ice cream manufacture.

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UNIT VIII. OTHER ASPECTS RELATED WITH THE FOOD INDUSTRY (5H)

Lesson 44.- Ready to eat foods. Types. Elaboration and preservation procedures. Problematic of ready to eat foods

Lesson 45.- Catering. Organization of a catering kitchen. Processing of foods by catering.

Lesson 46.- Design of a food industry. Characteristics of the processing area, distribution, auxiliary facilities. Processing control.

Lesson 47.- Water supply and treatment of food waste . Applications of water in the food industry. Water quality. Water purification. Characteristics of wastes of food industry: Biology demand of oxygen, chemical demand of oxygen. Procedures for treating wastes: physical, chemical and biological methods. Le

Laboratory lessons

Lesson 1.- Sensors for controlling food safety and quality. (4 H) Main sensor used in the food industry: temperature, pH, water activity, relative humidity,

Lesson 2.- Predictive Microbiology. (4 H) Programs and resources of predictive microbiology to predict factors affecting microbial growth and survival

Lesson 3.- Pilot plant for food processing. (4 H) Organization. Identification of the different equipments for food preservation and processing.

Lesson 4.- Processing of meat (4 H) Main physico-chemical and microbiological analysis in meat processing.

Lesson 5.- Milk processing (4 H) Main physico-chemical and microbiological analysis in milk processing.

SEMINARS

Seminar 1.- Thermal processing (4 H). Survival curve, thermodestruction curve. Graphical calculation of D_t and z values. F₀ parameter and botulinum cook.

Seminar 2.- Case. (2 H) It will be presented a practical issue related with food preservation and students will have to find the solution to the issue using different sources of information (books, internet etc)

Seminar 3 Meat and meat products (2 H) Discussion of a current issue related with the food industry.

Seminar 4 Milk and milk products (2 H) Discussion of a current issue related with the food industry.

Practicum

The activities related to this block will be carried out in their entirety in the CTA Pilot Plant, with the exception of the preparatory seminars (two). It is intended that the students, divided into small groups, carry out all the necessary stages for the elaboration 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 hygiene practices to be followed during the food processing process. The foods to be worked with have been chosen taking into account the theoretical program and facilities available at the pilot plant, and will include dairy products (yogurt, fresh cheese, other dairy derivatives) and meat (Frankfurters, fresh sausages, Chorizo, Longaniza, Chistorra, pâté...).

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4.4. Course planning and calendar

http://veterinaria.unizar.es/gradovet/horarios1.php?COD_TITULACION=6

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28439>