



Universitat de Lleida

# DEGREE CURRICULUM

# **FUNCTIONAL REQUIREMENTS**

# **OF SWINE PRODUCTION**

Coordination: GARCIA HERNANDEZ, ESTHER

Academic year 2022-23



# FUNCTIONAL REQUIREMENTS OF SWINE PRODUCTION 2022-23

## Subject's general information

Subject name	FUNCTIONAL REQUIREMENTS OF SWINE PRODUCTION				
Code	11012				
Semester	ANUAL CONTINUED EVALUATION				
Typology	Degree	Course	Character	Modality	
	Master's Degree in Agronomic Engineering	2	OPTIONAL	Attendance-based	
	Master's Degree in Swine Health and Production	1	COMPULSORY	Attendance-based	
Course number of credits (ECTS)	9				
Type of activity, credits, and groups	Activity type	PRACAMP	PRALAB	PRAULA	TEORIA
	Number of credits	1.3	0.5	1	1.5
	Number of groups	2	1	2	1
Coordination	GARCIA HERNANDEZ, ESTHER				
Department	ANIMAL SCIENCE				
Important information on data processing	Consult <a href="#">this link</a> for more information.				



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## Learning objectives

### Knowledge objectives

The student who passes the subject must:

The objective of the course is to analyze the factors that modify the use of nutrients as their interactions. On a practical level it is based on the elaboration of feeding systems, understanding as such the methods by means of which we formulate rations and obtain levels of production according to the specific needs of the animals and using varied foods.

### Goals

The student who passes the subject must be able to:

#### Block 1:

- 1.1 Know how to interpret the most basic aspects related to the structure, digestion and metabolism of nutrients.
- 1.2 To be able to interpret the structural and functional differences in the digestive system of omnivores and herbivores. To be able to differentiate the processes of allosteric digestion and microbial fermentation.
- 1.3 Know the origin, functions and destiny of each one of the nutrients
- 1.4 Know the importance of micronutrients, vitamins and minerals in these processes

#### Block 2

- 2.1 Know how to determine each of the immediate principles that make up the food. Know the most common analysis and fractionation methods in the different feeding systems.
- 2.2 Know the concept of digestibility, the most important methods to determine it and the factors that modify it.
- 2.3 Know the energy distribution in the animal organism and its foundations. Understand the theoretical division that allows us to assess energy food



2.4 Know the differential characteristics of the valuation systems for monogastric or ruminant species.

2.5 To know the protein valuation of the foods, more important methods and the differences derived from the presence of the rumen.

2.6. Know the protein titration systems for ruminants and monogastrics. Know the advantages and disadvantages.

2.7. Know the bases that govern the levels of voluntary ingestion of species of zootechnical interest. Be able to predict levels of ingestion knowing the impact of the specie and the physiological situation

## **Block 3**

3.1 Know how to establish the needs of different species in different physiological situations. The following will be considered: maintenance, growth and reproduction.

3.2 Know the factors that modify the maintenance needs, determination methods and factors related to the animal and the environment. Know the concept of thermal neutrality and the impact of different types of insulation.

3.3 Know and develop the concept of growth and differentiation. Knowing how to determine the needs in these processes, modifying factors and efficiencies.

3.4 Know how to establish the needs for the different reproductive functions, highlighting especially the needs during the gestation, lactation and during the laying process in the case of birds. Know the influence of food in these processes

## **Block 4.**

4.1 Be able to apply the knowledge learned to determine the most appropriate ration to the species of zootechnical interest, in each phase of its productive cycle taking into account the conditions of exploitation and addressing the corresponding aspects of hygiene, animal welfare and respect for the environment .

4.2 Know the feeding rules for each species and productive situation.

4.3 Be able to establish rationing programs that optimize the different productive situations, in conditions as intensive as extensive production.



## Competences

### General skills

Strategic competences of the University of Lleida

1. Domain of Information and Communication Technologies.
2. Regarding the fundamental rights of equality between men and women, to the promotion of Human Rights and the values of a culture of peace and democratic values.

### Transversal competences of the degree

1. Interpret studies, reports, data and analyze them numerically.
2. Work alone and in a multidisciplinary team.
3. Understand and express yourself with the appropriate terminology.
4. Discuss and argue in various debates.
5. Analyze and evaluate the social and ethical implications of the professional activity.
6. Have a critical and innovative spirit.

### Specific competences

1. Know the physiobiological processes associated with animal nutrition.
2. Know the different feeding and rationing systems of animals.
3. Be able to identify the different factors of production and raw materials for animal feed and its involvement in intensive and extensive animal production.
4. Be able to formulate rations

### Other competences

1. Bases of animal nutrition, formulation of rations and manufacture of feed.

## Subject contents

**1.- INTRODUCTION:** Nutrition and Food Concept. Flow of energy through the systems. Trophic chains. Objectives of the subject.

### **Block 1: Nature, digestion and functions of nutrients in the animal organism**

Topic 1. Nutrient Foods and Immediate Principles. Concept. Classification and biological functions of nutrients. Classification of foods as sources of nutrients.

Topic 2. Comparative digestion. Structural and functional differences of the digestive system of herbivores, omnivores, carnivores and birds.- Digestion and fermentation. Advantages and disadvantages of pre / post-gastric fermentation.

Topic 3. Origin, functions and destiny of the nutrients in the organism. Use of glucose and volatile fatty acids as an energy source and for the synthesis of fat. Synthesis of triglycerides. Origin and destination of amino acids. Protein renewal Synthesis of urea, gluconeogenesis, ketosis.

Topic 4. Vitamins and minerals. Function of vitamins and minerals to the organism. Physiological functions, deficiency effects and toxicity.

### **Block 2: Nutritional Assessment**

#### 2.1 Digestibility

Topic 5. Concept of digestibility and determination methods. Apparent digestibility, tests to determine it. Direct calculation and extrapolation. Indirect methods to estimate the use of indigestible markers. In vitro methods. Validity of digestibility coefficients. Real digestibility.

Topic 6. Factors that affect the digestibility. Factors dependent on the food. Prediction of food digestibility from chemical composition. Composition of the ration: associative effects. Effect of the feeding plan. Dependent factors of the animal.



## 2.2 Energy Assessment

Topic 7. The energy of food, use in the organism. Demand for energy Fundamentals of energy assessment. Losses in the process of use. Categories: Gross, digestible and metabolizable energy. Factors that affect the metabolizable energy content of food. Thermal increase Net energy. Retained energy and heat production.

Topic 8. Utilization of metabolizable energy. Concept of efficiency of use of metabolizable energy. Variation factors: efficiency of use for the different physiological functions and variations with the composition and quality of the food.

Topic 9. Energy assessment systems for monogastric foods. Systems based on the content of digestible and metabolizable energy. Systems based on net energy content. Most common forms of expression and prediction of the energy value of food in pigs, birds, rabbits and horses.

Topic 10. Energy assessment systems for ruminant feed. Systems based on the content of metabolizable energy. Blaxter system and subsequent modifications. Variable net energy system. Systems based on net energy content. French system of forage units. NRC systems for the fattening of calves and dairy cattle.

## 2.3. Protein Assessment

Topic 11. Protein valuation of food by monogastric. Methods based on growth tests. Methods based on nitrogen balance. Essential amino acids and limiting. Ideal protein concept. Ideal digestibility. Availability of amino acids. Carpenter method.

Topic 12. Protein valuation of ruminant feed. Nitrogen metabolism in the rumen. Origin of the protein to the duodenum. Degradability of the protein: variation factors. Methods for estimating the kinetics of rumen protein degradation and effective degradability. Synthesis of microbial protein and variation factors. Digestibility and biological value of the protein in the duodenum.

Topic 13. Protein titration systems for ruminant feed. British System (PM). French System (PDI). New systems based on mechanistic models (CNCRS de Conell)

## 2.4 Voluntary Ingestion

Topic 14. Factors that determine the levels of ingestion. General regulatory mechanisms. Regulation of ingestion in monogastric and ruminant species. Factors that affect voluntary ingestion: dependent on the animal, dependent on the diet. Concept of substitution coefficient and variation factors.

Topic 15. Prediction of voluntary ingestion. Monogastric. Ruminants Ballast unit system.

## Block 3. Nutritional Requirements

Topic 16. Maintenance Requirements (1) Concept of Requirements and recommendations. Basal metabolism and fasting. Factors that affect fasting metabolism. Energy expenditure per activity. Influence of climate: thermal neutrality interval and critical temperatures. Estimation of energy Requirements through feeding tests. Energy recommendations

Item 17. Maintenance Requirements (2) Protein maintenance requirements. Urinary endogenous nitrogen and faecal metabolic nitrogen: differences between monogastric and ruminant. Estimation of requirements through the factorial method and nitrogen balances. Requirements of vitamins and minerals. Requirements for wool production.

Topic 18. Requirements for growth. General considerations on development and growth. Dependent factors of the animal and of the feeding that affect the composition. Estimation of energy and protein requirements from the composition of weight gains and feeding tests. Requirements of vitamins and minerals.

Item 19. Requirements for reproduction. Effect of feeding on puberty and fertility in males and females. Energetic and protein requirements of the breeding animals. Quantitative and qualitative requirements to the service period: requirements for egg production.

Topic 20. Gestation requirements. Growth of the gravid uterus and its components. Thermal increase of gestation. Energy and protein requirements. Requirements in vitamins and minerals. Repercussions in maternal nutrition on the development of the fetus, the body reserves of the mother, the viability of the newborn and the subsequent lactation.

Topic 21. Requirements during lactation. Origin and synthesis of milk components. Evolution of the production and composition of milk during lactation. Energy and protein requirements. - Requirements of vitamins and minerals. - Influence of food on the production and composition of milk.

## Practical activities



Practice 1. Digestibility in birds - direct methods. Use of markers, digestibility in ruminants: indirect methods.

Practice 2. Practical formulation of rations. Preparation of a ration for a specific case individually proposed by each student.

Practice 3. Application of computer packages: INRATION

## Methodology

The teaching activity is structured in theory sessions and practices according to the calendar provided on the first day of class

5.1 Theoretical Classes: They are based on sessions of master classes where the corresponding topics will be presented. Each topic will be developed in approximately two hours.

5.2 Practical classes: The practicals will consist in experimentally determining some of the most important concepts when they have been developed in the master classes:

5.2.1: Determination of digestibility of MS and MO in monogastrics.

5.2.2: Rationing

5.3: Problems and cases: they will consist of the simulation of practical cases to develop, of individual rationing or by group, in the second case the student will be initiated in the management of rationing programs for ruminants and monogastrics.

5.4: Seminars: Study will consist of certain aspects of the subject, so a study will be presented that will be presented in class. Based on the reports and presentations, practical cases will be considered that students will have to solve.

5.5: Report: Based on certain foods that will be provided at the end of the course, the students should elaborate to solve a ration, suitable for a practical case that will also be assigned to them.

Observations

25 hours of total activity have been considered by ECTS credit.

## Development plan

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Type of activity	Description	Dedication	week	Groups	Objective
THEO	Topic 1: Nutrient Foods and Immediate Principles	1	1	1	1
THEO	Topic 2: Comparative Digestion	2	2,3	1	1
THEO	Topic 3: Origins, functions and destination of nutrients to the organism	2	3	1	1
THEO	Topic 4: Vitamines and Minerals	2	3	1	1
SEM	Seminari 1: Macro and Micro-Minerals	2	3	1	1
SEM	Seminari 2: Water-soluble vitamins	2	3	3	1



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## Evaluation

1. At the end of each theoretical block (4) there will be a test that will be worth 15% of the final mark of theory that will constitute 60% of the final mark, although it will be essential to obtain a minimum of 4,00 in the average qualification of theory to be able to pass the subject.

2. The exam will be done during the last lecture hour of each block and will consist of:

- a. -25% of questions "Test"
- b. -25% of short questions,
- c. -25% of questions to develop
- d. -Problem or practical case related to block theory

3. The practical block will represent 40% of the final grade and will consist of:

- Digestibility practices (60% of the practical qualification: 30% exam of data processing to excel and 30% of final report of digestibility practice)
- Vitamins Seminars (20% of the practical qualification)
- Final report, based on theoretical data of food, species and physiological situation, the student must draw up a ration of which he must reasonably justify the physiological efficiency (20% of the practical qualification)

## Bibliography

### Basic bibliography

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### Complementary bibliography

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UNDERWOOD, E.J. 1983. *Los minerales en la nutrición del ganado*. Ed. Acribia. 2ª Ed. UNDERWOOD, E.J. i SUTTLE, N.F. 1999. *The mineral nutrition of livestock*. 3rd Ed. CABI Publishing.

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WISEMAN, J. i GARSWORTHY, P.C. 2001. *Recent Development in Pig Nutrition 3*. Nottingham University Press.