Universitat de les Illes Balears

Teaching guide

Academic year	2015-16
Subject	10273 - Design of Experimental Studies and Statistics Applied to Nutrigenomics
Group	Group 1, 1S
Teaching guide	A
Language	English

Subject identification

Subject	10273 - Design of Experimental Studies and Statistics Applied to Nutrigenomics
Credits	0.6 de presencials (15 hours) 2.4 de no presencials (60 hours) 3 de totals (75 hours).
Group	Group 1, 1S (Campus Extens)
Teaching period	First semester
Teaching language	Spanish

Professors

Lecturers	**Horari d'atenció als alumnes**					
	Starting time	**Finishing time**	**Day**	**Start date**	**Finish date**	**Office**
Teresa Priego Cuadra teresa.priego@uib.es	You need to book a date with the professor in order to attend a tutorial.					

Contextualisation

TEACHER: Teresa Priego (Biology PhD, 2004) is a researcher at the Laboratory of Molecular Biology, Nutrition and Biotechnology (Nutrigenomics) of UIB (since 2005). Herresearch is focusedin the field of molecular nutrition and, in particular, the study of obesity, the mechanisms of body weight regulation, and the effects of certain nutrients on these proceses. She hadparticipated or is participating in more than 25 projects / research contracts. She is author of 50 scientific publications listed in Science Citation Index in various prestigious internacionaljournals. She is a member of a European Network of Excellence on Nutrigenomics (NuGO) and CIBERobn from Health Institute Carlos III.

SUBJECT: 'Design of Experimental Studies and Statistics Applied Nutrigenomics' is a compulsory subject in the Master in Nutrigenomics and Personalised Nutrition, it is located in Module 1, "Fundamentals of Nutrigenomics and Personalised Nutrition".
This course seeks to initiate students in the experimental design and in the statistical methodology in the context of nutrigenomics. The course is both theoretical and practical and is therefore intended that, on the one hand, students acquire a solid understanding of the process of experimental design and of the bases of the statistical tools but, on the other hand, it is intended that students learn to correctly apply these techniques (using specialized statistical software) and acquiring the ability to interpret statistical results with scientific rigor.

Learning Outcomes:

* Summarize the main types of designs used in clinical and basic research in the area of nutrigenomics
* Make proper and efficient use of statistics tools currently available to analyse data from omics techniques
* Correctly interpret the results of data analysis and execute different statistical tests in the contextof nutrigenomics

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* Properly discuss the results published in the scientific literature in the area of nutrigenomics

Requirements

Recommendable

Knowledge of Excel.
Basic knowledge of data management and analysis.

Skills

Specific

* Ability to work proficiently in a professional environment related to nutrigenomics, personalized nutrition, molecular nutrition and functional foods.
* Correctly apply the statistical analysis in the field of nutrigenomics.

Generic

* Knowing the capabilities and potential of ICT (Information and communications technology) in the discipline area.
* Ability to formulate hypotheses and design research studies.
* Ability to analyze data and draw conclusions from research results.
* Ability to search, organize and critically analyze the research literature related with the discipline.

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

The course will develop all the contents selected and listed below. These contents will be developed in lectures, in which the concepts and fundamentals of each topic will be introduced, and in practical classes (workshops) in which the statistics tools to solve specific problems in the field of Nutrigenomics will be applied.

Theme content

Session 1. Principles of experimental design applied to Nutrigenomics
* Designs and types of studiescommonly used in the field of Nutrigenomics. Most representative examples.
* Principles of experimental design.
* Sample size calculations, limitations in the application of Nutrigenomic-based techniques

Session 2. Descriptive statistics applied to data obteined from omics techniques
* Descriptive statistics: central tendency measurements, dispersion, types of distributions.
* Exploratory data analysis (EDA).

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* Quality control of data and normalization techniques.
* Outliers identification and exclusion criteria.

Session 3. Hypothesis testing and multiple comparison procedures
* Statistical inference,hypothesis testing,Type I and Type II errors,significance level,procedure for hypothesis testing,decision rules.
* The problem of multiple comparisons when working with omics data. Methods formultiple testing correction, FDR and Bonferroni correction.

Session 4. Types of statistical test used in the field of Nutrigenomics
* Unilateral and bilateral tests.Finding differences between two sample means, Student's t test and Chi square. Paired observations or repeated measurements.
* Bases and assumptions of ANOVA. Post-hoc test. Repeated measures ANOVA.
* Multifactorial ANOVA. Concept of interaction.
* Multifactorial repeated measures ANOVA.
* Linear Regression and Correlation. The regression line. Standard error of estimate. Correlation coefficient. Multiple and partial correlation.
* Non-parametric statistics. Scope and assumptions. Kruskal-Wallis test and Wilcoxon Mann-Whitney, Kolmogorov-Smirnov test.

Session 5. Introduction to multivariate analysis (MVA)
* Importance ofmultivariate analysis in the field of Nutrigenomics.
* Principal component analysis(PCA).

Session 6. Statistics applied to epidemiology and diagnosis in the field of nutrigenomics
* Major epidemiological indicators.
* Diagnostic test evaluation, ROC curves.
* Representative examples in the field of Nutrigenomics.

Teaching methodology

Learning and teaching activities:
Activities carried out by tutor with students:
- Lectures
- Seminars for student presentation and discussion
- Workshops with case studies
- Computer-based analysis
- Tutorials

Activities to be carried out by students independently:
- Reading of recommended bibliography and study of lectures
- Literature searches
- Problem solving

Activities to be carried out by students in group:
- Reading and preparation of a critical comment (from a statistic point of view) of a scientific paper (or research work) chosen by the students
- Preparation of a seminar of the critical comment of a scientific paper
- Seminar presentation

In-class work activities

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Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	**Purpose:** presentation and explanation of the main contents of the course. **Methodology**: participatory lectures. To facilitate the understanding of concepts and the lectures follow-up, a power-point presentation will be proyected, indicating the main topics of the subject and with diagrams and examples of the more difficult concepts. These slides will be uploaded in the specific Campus Extens space of the subject in order to facilitate that students come to class having reviewed and worked the material.	6
Seminars and workshops	Seminar presentation	Medium group (M)	**Purpose:** To assess the degree of acquisition of basic knowledge of the subject, which includes managing of specific vocabulary, important concepts and current statistical tools, as well as the ability to synthesize and organize information from the literature. To stimulate the student to apply critical analysis and to develope speaking skills. **Methodology**: Students in groups of 2-3 will present to the rest of the class, a seminar of a critical comment (from a statistic point of view) of a scientific paper (or research work) chosen by the students with teacher approval.	3
Practical classes	Practical laboratory	Large group (G)	**Purpose:** To apply the knowledge acquired in lectures. These workshops include solving exercises and problems, with the teacher help, on data management (organization, storage and treatment) and the application of various statistical tests (t-test, Chi square, ANOVA, correlations and nonparametric test) with hypothetical data related to the field of nutrigenomics. **Methodology:** Problem based learning. This activity will be held in the computer room in order to use specialized software for statistics (SPSS). The teacher will guide the student to use the SPSS program.	6

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Problem solving	**Purpose**: To assess the degree of knowledge of the student and the capacity to apply statistical tools correctly with a set of proposed problems related to studies in the field of nutrigenomics **Methodology:** Problem based learning in an individual self-study way. To develop this activity the use of any statistical software, for solving some of the problems, will be required (SPSS is available in all computer rooms of the University).	40

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Modality	Name	Description	Hours
Group self-study	Seminar preparation	**Purpose:** To stimulate critical thought and the ability to synthesize and organize relevant information and to interpret statistical results with scientific rigor. It is also intended to develop teamwork skills. **Methodology**: Students in groups of 2-3 will have to prepare a seminar of a critical comment (from a statistic point of view) of a scientific paper (or research work) chosen by the students with teacher approval.	20

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

To assess the knowledge acquired by students will be taken into account the acquisition of theoretical knowledge but also practical (including the ability to properly apply each statistical technique, what are the data requirements and how to interpret correctly the results of data related to Nutrigenomics) by solving a set of questions, problems and exercises, it is also intended to asses the acquisition of communication skills, critical analysis and the capacity to connect properly the various aspects of the subject by presenting a workshop.
Raises two routes, the pathway A (continuous assessment) in which the assistance and class participation will be evaluated in addition to the other tools (problem solving and workshop). And the pathway B (final examination), which only take into account the other criteria of assessment (problem solving and workshop).

Seminar presentation

Modality	Seminars and workshops
Technique	Attitude scales **(retrievable)**
Description	Purpose: To assess the degree of acquisition of basic knowledge of the subject, which includes managing of specific vocabulary, important concepts and current statistical tools, as well as the ability to synthesize and organize information from the literature. To stimulate the student to apply critical analysis and to develope speaking skills. Methodology: Students in groups of 2-3 will present to the rest of the class, a seminar of a critical comment (from a statistic point of view) of a scientific paper (or research work) chosen by the students with teacher approval.
Assessment criteria	It will be assessed the conciseness, accuracy and clarity of presentation, the oral communication, the use of terms learned during the course and the ability to relate the concepts learned. Also attendance and active involvement in the discussion of the classmate's seminars will be evaluated.

Final grade percentage: 20% for the training plan A
Final grade percentage: 20% for the training plan B

Practical laboratory

Modality	Practical classes
Technique	Real or simulated task performance tests **(non-retrievable)**
Description	Purpose: To apply the knowledge acquired in lectures. These workshops include solving exercises and problems, with the teacher help, on data management (organization, storage and treatment) and the application of various statistical tests (t-test, Chi square, ANOVA, correlations and nonparametric test) with

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	hypothetical data related to the field of nutrigenomics. Methodology: Problem based learning. This activity will be held in the computer room in order to use specialized software for statistics (SPSS). The teacher will guide the student to use the SPSS program.
Assessment criteria	Resolution and discussion of the exercises proposed in class. It will be assessed by assistance, active participation, accomplishment of the tasks and quality of the answers.

Final grade percentage: 20% for the training plan A
Final grade percentage: 0% for the training plan B

Problem solving

Modality	Individual self-study
Technique	Extended-response, discursive examinations **(retrievable)**
Description	Purpose: To assess the degree of knowledge of the student and the capacity to apply statistical tools correctly with a set of proposed problems related to studies in the field of nutrigenomics Methodology: Problem based learning in an individual self-study way. To develop this activity the use of any statistical software, for solving some of the problems, will be required (SPSS is available in all computer rooms of the University).
Assessment criteria	Evaluation of all the contents of the subject by a set of proposed exercises. The questions will try to show that the student has understood the concepts and is able to connect properly the various aspects of the subject. Assessment: accomplishment of the tasks, delivery on time and quality of the answers.

Final grade percentage: 60% for the training plan A
Final grade percentage: 80% for the training plan B

Resources, bibliography and additional documentation

Basic bibliography

1) Ahrens, W. y Pigeot, I. (2005). Handbook of epidemiology. Berlin: Springer
2) Altman, D.G. (1991). Practical statistics for medical research. Boca Raton: Chapman and Hall.
3) Álvarez, R. (1994). Estadística multivariante y no paramétrica con SPSS: Aplicación a las Ciencias de la Salud. Madrid: Díaz de Santos.
4) Catena, A.; Ramos, M. y Trujillo, H. (2003). Análisis multivariado. Un manual para investigadores. Madrid: Biblioteca Nueva.
5) Cobo, E.; Muñoz, P. y Gonzalez, J.A. (2007). Bioestadística para no estadísticos. Bases para interpretar artículos científicos. Barcelona: Elservier Masson.
6) Garrido, G. (2002). SPSS aplicado a las ciencias de la Salud. Madrid: Ra-Ma.
7) Johnson, R. y Wichern, D. (2002). Applied Multivariate Statistical Analysis (5th edition). Upper Saddle River, NJ: Pearson Education.
8) Montgomery, D.C. (2001). Design and analysis of experiments. New York: John Wiley & Sons.
9) Rial, A. y Varela, J. (2008). Estadística Práctica para la investigación en Ciencias de la Salud. La Coruña: Netbiblo.
10) Tinsley, H. y Brown, S. (2000). Handbook of Applied Multivariate Statistics and Mathematical Modeling. San Diego: Academic Press

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