Manonmaniam Sundaranar University, Tirunelveli-12.

PhD Nutrition and Dietetics

COURSE WORK PAPER with effective from (2020-21) onwards

Sl.No.	Course Work Papers	Credit
1.	Research Methodology and Statistics in Nutrition	4
2.	Nutrigenomics	4
3.	Personalized Nutrition and Biohacking	4
4.	Food Microbiology and Food Safety (MOOC)	4
5.*	Research and Publication Ethics	2
6.	Mini Project	4

* Refer Ph.D Common syllabus for all

RESEARCH METHODOLOGY AND STATISITCS IN NUTRITION

Course Credit - 4

Objectives

- To enable the students
- To enrich the knowledge in research and to design research.

Course Outcome:

CO No	Expected course outcomes	Cognitive level
CO 1	Understand some basic concepts of research and its methodologies related to food science and nutrition	**Understanding**
CO 2	Select and define appropriate research problem and parameters	**Knowledge**
CO 3	Propose and distinguish appropriate research designs and methodologies to apply to a specific research project	**Create**
CO 4	Develop a comprehensive research methodology for a research question	**Create**
CO 5	Apply the understanding of feasibility and practicality of research methodology for a proposed project	**Application**

UNIT 1

Research Methodology: Meaning and Objectives of research; Types of research [Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Field setting vs. laboratory, clinical vs. diagnostic, Exploratory vs. Formalized]; Research Approaches [Qualitative approach and Quantitative approach] Significance of research; Basic concepts about research and scientific method; Research process. Hypothesis, designing research-different types- Completely randomized design, Randomized block design, Latin square design, Factorial design, and Trend analysis

UNIT 2

Nutritional epidemiology

i. Levels of epidemiologic research (primary, secondary and tertiary prevention)
ii. Observational studies – cross-sectional, case-control, cohort (prospective, retrospective, time- series)
iii. Types of analysis – eg., incidence rate, prevalence rate.

UNIT 3

Experimental studies

i. Pre-clinical studies - Laboratory based in vitro and animal studies
ii. Clinical studies - Human intervention trials. Types - Randomized controlled trials (RCT), Non-randomized trial.
C. Ethical issues, Informed consent process, Regulations and Guidelines for research on human subjects

UNIT 4

Nutrition research - Data collection- Principles, definition and examples in nutrition research for the following.

A. Quantitative tools i. Direct parameters – Application of anthropometry, dietary survey, clinical, biochemical and growth monitoring tests, body composition tests and physical fitness tests. ii. Indirect parameters –vital statistics, population tests, socio – economic indices, KAP surveys.

B. Qualitative research tools- Types of interviews, Focus group discussions, Free listing and pile sorting, Narrative, Case studies, Participatory methods.

C. Integrating qualitative and quantitative methods.

D. Nutrition Intervention: Tools & techniques to facilitate nutrition intervention. Biomarkers and their use in nutrition intervention

UNIT 5

Data Management and Analysis

Quantitative analysis, descriptive statistics, inferential statistics: Uses and limitations Summation sign and its properties. Data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.).

Proportions, percentages, ratios

Measures of central tendency-mean, median, mode arithmetic mean and its uses, mid – range, geometric mean, weighted mean, measures of dispersion /variability- range, variance, standard deviation, standard error, coefficient of variation, Kurtosis, Sleekness

References:

1. Lovegrove, Julie & Hodson, Leanne & Sharma, Sangita & Lanham-New, Susan. (2015). "Nutrition Research Methodologies", John Wiley & Sons, Ltd.

2. Kothari, C.R. (2000). "Research Methodology: Methods and Techniques", Wishwa Prakashan, New Delhi.

3. Gupta, S. (2001). "Research Methodology and Statistical Techniques",Deep and Deep, New Delhi,

4. Hooda, R.P. (2003). "Statistics for Business and Economics", 3rd ed., Macmillan IndiaLtd., Delhi.

NUTRIGENOMICS

Course Credit - 4

Objectives:

To enable students to:

- Gain Knowledge of how diet and underlying genetics interact to increase susceptibility to disease.
- To identify the methods and strategies used to study complex trait genetics and nutrition

Course Outcomes

To enable the students to

CO	Course Outcomes	Cognitive Level
CO-1	Develop an understanding of genomics and gene regulation with respect to diet	Understanding
CO-2	Formulate an appreciation for the role and importance of nutrition in prevention of polygenic diseases	Create
CO-3	Apply nutrigenomics and to design nutritional strategies for prevention of chronic diseases such as cardiovascular disease, obesity, type-2 diabetes, bowel diseases and cancer	Application
CO-4	Relate the interactions between the expression of various genes and the intake of various nutrients	Applicaion
CO-5	Outline the various techniques used in nutrigenomics	Knowledge

Unit 1:

Introduction to gene-diet interactions

Nutrigenomics: Scope and Importance to Human Health and Industry Transporter gene polymorphisms -interaction with effects of micronutrients in humans. Polymorphisms in genes affecting the uptake and transport of omega-6 and omega-3 polyunsaturated fatty acids: interactions with dietary lipids and chronic disease risk. Nutrigenomics approaches to unraveling physiological effects of complex foods. The intestinal microbiota - role of gut microbiome in nutrigenomics.

Unit 2:

Modifying disease risk through nutrigenomics:

Modulating the risk of cardiovascular disease, diabetes, cancer, obesity and inflammatory bowel diseases and malnutrition through nutrigenomics.

Overview of lipid metabolism; cholesterol metabolic pathway; hyperlipidaemia, LDL receptor mutations.

Relevance of folate, vitamin B12; hyperhomocysteinemia and gene polymorphisms in diseases.

Unit 3:

Influence of maternal nutrition on fetal gene expression. Obesity, genetic predisposition, candidate genes like leptin, FTO and other hormones involved in the control of appetite. Baker's hypothesis

Polyunsaturated fatty acid and their roles in the control of gene expression example lipogenesis and lipid oxidation pathways

Polyphenols. transcriptomic analysis on the effect of the polyphenols in the human diet.

Unit 4:

Technologies in nutrigenomics genomics techniques:

Different sequencing approaches, Microarray, Massarray, Single Nucleotide Polymorphism genotyping, PCR and RT-PCR techniques

Proteomics techniques: 1-D, 2-D gel electrophoresis, DIGE, novel peptide identification, peptide sequencing methods

Metabolomics techniques: Chromatography and mass spectrometry techniques, Discovery and validation of biomarkers for important diseases and disorders. **Computational approaches:** Introduction to different types of public domain databases, data mining strategies, primer designing.

Unit 5:

Bringing Nutrigenomics to Industry, Health Professionals, and The Public:

Bringing nutrigenomics to the food industry: Industry-Academia partnerships as an important challenge; Bringing nutrigenomics to the public: Is direct-to-consumer testing the future of nutritional genomics.Interaction with health professionals in bringing

nutrigenomics to the public; Is contemporary society ready for nutrigenomic science.Public health significance of nutrigenomics and nutrigetics

References:

1. Lehninger Principles of Biochemistry. Macmillan. 2008
2. Ordovas: Nutrigenetics and Nutrigenomics. Wiley. 2004
3. Brigelius-Flohe, Joost: Nutritional Genomics. Wiley. 2006.
4. Rimbach, Fuchs, Packer: Nutrigenomics, CRC Press. 2005

PERSONALIZED NUTRITION AND BIOHACKING

Course Credit - 4

Objectives:

To enable students to

- Acquire advanced knowledge of the physiological, molecular, and biochemical concepts involved in how nutrients regulate gene expression
- Develop a distinctive understanding of how an individual's genotype influences their nutrient requirements.
- Develop an advanced understanding of the unique roles that foods, nutrients, and micro-compounds therein play in chronic diseases with a focus on their role in nutritional genomics.

Course Outcomes:

CO	Course Outcomes	Cognitive Level
CO-1	Apply the foundations of nutrigenomics and personalized nutrition in health promotion.	Application
CO-2	Analyze how an individual's genotype may influence their nutritional requirements and be involved in the development of chronic disease.	Knowledge
CO-3	To be able to analyze the benefit / risk balance of dietary recommendations and interventions according to the genotype.	Analysis
CO-4	Justify the importance of taking care of diet in the perinatal period for health in adulthood.	Evaluation
CO-5	Realize the applicability of the science in practice, examining the current testing that is available i.e through Biohacking	Analysis

UNIT 1:

Origin of the concept of Personalized Nutrition, Definition, Introduction, Nutrigenomics for personalized nutrition.

Human Genomic Variations: - Diversity of human population. - Metabolism, genetics, and environment. - Nutritional implications. - Nutritional requirements. - Genetic variation and physical performance.

Molecular Basis of Genetics: - Metabolic control and mechanisms. - Nutrient and gene expression. - Nuclear receptors. - Role of PPARs. - Role of the immune response. - Metabolic-circadian control.

UNIT 2:

Nutrition and Human Genome Adaptation: - Genetic adaption to dietary changes. - Omics analysis in nutrition. - Nutrient-gene interactions. - Genetics and lipid metabolism. - Genetics and CHO metabolism. - Genetics and protein metabolism. - Genetics and vitamin metabolism. - Genetics and mineral metabolism. - Personalized nutrition.

UNIT 3:

Nutritional Epigenomics: - Mechanisms of epigenetics. - Metabolism and epigenetic signaling. Epigenetic programming in humans. - Nutritional signaling and aging. Inflammation, metabolic stress and genetics.

UNIT 4:

Modern Technologies for personalized nutrition, Personalized nutrition for women, infants, and the child population, Personalized nutrition for athletes, Consumer acceptance of personalized nutrition. Perinatal programming Diet in early life and metabolic programming. Case studies in nutrigenomics, nutrigenetics and personalised nutrition

UNIT 5:

Biohacking – Introduction. Biohacking through Self Tracking, Human Performance improvement and Human Enhancement. Types of Biohacking - Nutrigenomics in Biohacking, DIY Biology, Grinder. Biohacking with nootropics. Transhumanism. Pros and Cons of Biohacking – Legal and ethical issues involved in biohacking.

References:

1. Charis Galanakis (2019), “Trends in Personalized Nutrition”, Academic Press, USA.
2. Frans Kok, Laura Bouwman, Frank Desiere (2019), “Personalized Nutrition – Principle and Application” CRC Press, UK
3. George Moschonis, Katherine Livingstone and Jessica Biesiekierski (Eds.) (2019) “Personalized Nutrition”, MDPI, Switzerland

Food Microbiology and Food Safety (MOOC)

Course Credit – 4

UNIT: I

Introduction to Food Microbiology and Food Safety
Microflora of Food
Intrinsic Factors Affecting Microbial Growth and Survival in Food

UNIT II
Extrinsic Factors Affecting Microbial Growth and Survival in Food
Microbiological Examination of Food
Advances in Isolation and Enumeration of Microorganisms in Food

UNIT III
Principles of Food Preservation and Significance
Preservation of Food by Physical Methods – Low and High Temperatures
Preservation of Food by Physical Methods – Radiations

UNIT IV
Preservation of Food by Chemical Methods
Biopreservation of Food
Assignment-I

UNIT V
Modified Environment for Storage of Food
Fermentative Microorganisms as Food and Value-Added Product
Lactic Fermentation in Food

UNIT VI

Yeast-Lactic Fermentation in Food
Mold-Lactic Fermentation in Food
Starter Cultures for Food Fermentation

UNIT VII
Fermented Milk
Fermented Milk Products
Fermented Juice, Vegetables and other Beverages

UNIT VIII
Fermented Meat
Fermented Fish Products
Assignment-II

UNIT IX
Introduction to Food Spoilage
Spoilage of Fruits, Vegetables, and their Products
Spoilage of Dairy Products

UNIT X
Spoilage of Canned Food
Spoilage of Bakery and Egg Products
Spoilage of Meat, Fish, and Sea Food

UNIT XI
Newer Methods for Controlling Spoilage of Food
Predictive Modelling for Food Spoilage
Assignment-III

UNIT XII
Foodborne Outbreaks- Bacterial Agents for Foodborne Illnesses
Fungal and Algal Agents for Foodborne Illnesses
Foodborne Animal Parasites

UNIT XIII
Investigation of Foodborne Illnesses Outbreaks
Indicators of Food Microbial Quality and Safety
Principles and Applications of Hurdle Technology in Food Industry

UNIT XIV
Principles of Hygiene and Sanitation in Food Service Establishment.
Food Safety Laws

Food Safety and Quality Management System

UNIT XV

Principles and Guidelines for Conducting Microbiological Risk of Food
Revision of the course
Final assessment/Term-end examination

Books and references

- Adams MR and Moss MO. (1995). Food Microbiology. 4th edition. New Age International (P) Limited Publishers, New Delhi, India.
- Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
- Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
- Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
- Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
- Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
- Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
- Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
- Matthews KR,Kniel KE, and Montville TJ. (2017). Food Microbiology: An introduction. 4th edition, ASM Press.
- Pederson CS. (1971). Microbiology of Food Fermentations. Westport, CT: AVI.
- Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
- Tanner FW, and Tanner LP (1953). Food-Borne Infections and Intoxications. 2nd edition. Champaign, IL:Garrard Press.

Mini Project

Course Credit – 4