

Module Title:	Food Fermentation
Language of Instruction:	English
Credits:	5
NFQ Level:	8
Module Delivered In	1 programme(s)
Teaching & Learning Strategies:	This module will be delivered through 48h of lecture and 24h of practical laboratory classes. Lectures will be interactive and include discussion, reflection and review of relevant research.
Module Aim:	Introduce students to the variety of fermented food and beverage products that are used in Ireland and across the world to preserve and enhance food.
Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Summarize the relationships between the intestinal flora, the immune system, diet and health. Describe the range of Irish & global fermented food products and appraise their value in good health and the economy. Recognize the role of chemical preservation in the food industry: discuss cheap soy sauce, pickled onions, Chorleywood process. Evaluate the production of carcinogens as the downside of fermentation.
LO2	Identify the principal Lactic Acid Bacteria used to transform grains and milk into digestible food such as sourdough bread, yoghurt, quark, koumiss and kefir. Appreciate the value and complexity of cheese fermentation and differentiating among the bacteria and fungi that create it. Describe the production of acetic acid as secondary product from ethanol and its industrial and economic importance. Categorize organic acids (citrate, lactate and glutamate) as food industry products and appraise their economic importance.
LO3	Catalogue, describe and critical analyze some foreign fermented vegetable products (sauerkraut and kimchi); dry fermented meat products (chorizo, pepperoni); filamentous fungi fermented beans (tofu, tempeh, soy sauce, miso), and assess their potential in the Irish market. Experiment with Fermentation and create and evaluate a variety of fermented products.
Pre-requisite learning	
Module Recommendations <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Intestinal flora

There are 200 trillion cells in our guts mostly bacterial from 10,000 different species. They are vital for vitamin production, efficient digestion, immunological protection and general well-being

Fermented food overview

Definition and characterization of Fermentation process and potential classifications. Homofermentative and Heterofermentative fermentation. Flavors and their origins. Chemistry and Biochemistry of sugar transport and utilization.

Microbial Fermentation

Microbial classification of Fermentation. Characterization of Lactic Acid Bacteria (LAB) and description of major groups. Yeast and Fungal Fermentation.

Starter Cultures

General considerations. Definition and attainment of starter culture. Defined vs undefined. Maintained and production of starter culture. Heap-Lawrence test. Phage controlling strategies.

Cultured Dairy Products

Definition and characterization of cultured dairy. Probiotics and prebiotics, Inulin FOS and GOS. Yogurt :types and manufacture. LAB and their metabolism. EPS and their role in Yogurt production. Role of LAB and Lactose tolerance. Cultured buttermilk, Kefir and sour cream. Role and development of diacetyl in cultured dairy.

Cheese

Description, classification and role of microbes in cheese production. Casein and Chymosin. Description of the main cheese types and their specific fermentation characteristics.

Bread and its process

Bread and its standard process. Yeast in bread fermentation. Straight dough and Chorleywood process. Sourdough fermentation, types and bacterial characterization of sourdough bread. Extraction rate. Flavor and taste development and factor influencing it.

Vegetable Fermentation

Identification of main principles and characteristics. Description of key model types such as sauerkraut, kimchi, olives and pickled products. Bacterial metabolism and implication to the end products.

Meat Fermentation

Role of microorganisms in meat fermentation. Bacteriocins roles and classification. Culture and curing agents. HACCP analysis. Mold ripening and post fermentation processes.

Fermented beans

koji manufacture and fungal cultures. Characterization of the main product types: Soy sauce, tofu and soy milk , miso, natto, tempeh and sake. Roles of fungi and other microbial organisms in Asian food preservation and development. Mycotoxins risk in fungal fermentation. Fish fermentation.

Proteolytic digestion:

You can release the umami-rich flavors from soya beans by long slow fermentation or you can produce glutamate by a proteolytic digestion in a vat. Industrial vinegar can replace bacteria-produced lactic acid. lactic acid

Downside

Fermentation is necessarily a complex process which is only partly understood. By-products include a cocktail of chemicals which may not all be 'healthy'.

Practical Component

Dairy culture characterization, and use in making yogurt. Sourdough from start to end. Analyses of its microbial diversity (bacteria and yeasts). Kimchi: preparation and evaluation of its organoleptic properties. Fermented juices. Sauerkraut, vinegar and kombucha.

Assessment Breakdown	%
Continuous Assessment	10.00%
Project	10.00%
Practical	40.00%
End of Module Formal Examination	40.00%

Special Regulation

Students must achieve a minimum grade (35%) in both the practical/CA and final examination.

Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Essay	Invent a novel Irish food product that requires fermentation or enzymatic processing. Describe ingredient sources, manufacture and marketing as problems that need to be solved.	1,2,3	10.00	n/a

Project				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Project	Present a food product that you have never eaten: talk about its production methods, production costs, health benefits and health contra-indications	1,2,3	10.00	n/a

Practical				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Practical/Skills Evaluation	Perfecting edible food-products using the techniques of fermentation: sourdough bread, yoghurt, sauerkraut and kefir.	2,3	40.00	n/a

End of Module Formal Examination				
<i>Assessment Type</i>	<i>Assessment Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Formal Exam	Examination to demonstrate understanding of the learning outcomes.	1,2,3	40.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	12 Weeks per Stage	4.00
Laboratory	12 Weeks per Stage	2.00
Assignment	15 Weeks per Stage	3.53
Total Hours		125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_SABRE_B	Bachelor of Science (Honours) in Brewing and Distilling	8	Mandatory