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Food Fermentations for Purpose: Health promotion and Biopreservation (LONGLIFE)

Key external stakeholders:

DAFM, dairy and other functional foods companies, infant milk formula industry,

Practical implications for stakeholders:

- LONGLIFE's goal is to deliver new knowledge on the fate and function of food constituents and determinants of bio-accessibility, bioavailability and efficacy of food ingredients to advance fermented functional food design. LONGLIFE focussed on innovative processing of the food substrates; milk, cereals, meat.
- Results of this study delivered new knowledge on the fate and function of food constituents and determinants of bio-accessibility, bioavailability and efficacy of food ingredients to advance fermented functional food design.
- We identified and characterised food grade cultures with EPS, polyol antimicrobial and antifungal-producing properties.
- We developed natural bio-engineered fibre-based ingredients and food products capable of releasing functional bioactive compounds.
- We developed a range of next generation fermented foods with superior nutritional, health and techno-functional properties.
- The scientific findings and technological solutions were shared with relevant stakeholders.

Main results:

Based on pre-selection of starter bacteria capable of producing bioactive metabolites (exopolysaccharides (EPS), polyols and antimicrobial compounds) and their use during fermentation of milk, cereals and meat, we improved the fermentation process by manipulating processing conditions to optimise food properties and developed a range of fermented milk, meat and cereal-based products for health and economic benefit. Characteristics such as digestibility, palatability, stability and quality of the finished products were taken into consideration to ensure highly marketable products were developed. Additionally, new prebiotic ingredients were developed based on superheated steam (SHS) processing of bran substrates, for enhancing bio-functionality in food/beverages.

Opportunity / Benefit:

The project's results have a positive impact on the food industry through the innovative processes developed which can improve food processing efficiency, lead to new markets and increased competitiveness. The developed products with improved functionality and shelf-life will contribute to more sustainable food production and nutrition security, benefitting the health of citizens, society and the economy.

Collaborating Institutions:

Teagasc, University College Cork, University of Bologna, TNO The Netherlands, AgResearch Ltd, New Zealand, PAS, Poland, Industry partner (Barilla).

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1. Project background:

Fermentation has been exploited by mankind for millennia to preserve and enhance food. Fermented foods have a healthy, natural, clean label and safe image, but current practices for many food fermentations (broad spectrum activities of natural fermentation) are generally based on traditional methods, where specific culture selection methodologies are applied with focus on techno-functional characteristics as opposed to bio-functional capacity of the microbiota used in the fermentation process. Although fermented foods are generally accepted by consumers as healthy alternatives to foods processed by other methods, the mechanism whereby fermented foods are further digested in the human digestive tract have not been fully elucidated or understood. Lactic acid bacteria (LAB) fermentation of milk enhances final product texture, sensory and health promoting qualities, due to the functional bioconversion of milk constituents. Additionally, lactose is metabolised during milk fermentation, thus mitigating a potentially problematic sugar in dairy for lactose intolerant consumers. Sourdough is a traditional technology where a mixture of flour and water is fermented with LAB and yeast to enhance flavour and leavening of bakery products. The microbes determine the sourdough characteristics via acid production, aroma and leavening properties. Besides effects on aroma, structure and shelf-life, sourdough may have important nutritional benefits. It has been shown to reduce starch digestibility (low GI), increase content of bioactive compounds (e.g. vitamins) and improve bioavailability of potentially beneficial bioactive compounds. The positive effects of sourdough are mainly due to the metabolic activities of LAB and acidity induced enzymatic changes in the cereal matrix. Selection of sourdough LAB based on functional properties may be considered as a tool to improve the technological, sensorial and nutritional value of novel “personalised” food and beverage products. LONGLIFE will involve innovative processing of food substrates (milk, cereals and meat) into fermentates, using novel strains of LAB and yeasts to produce value-added fermented liquids and powders, grain-derived foods and beverages, long-fermented sourdough bread, and meat products with improved health benefits, organoleptic qualities and extended shelf-life.

2. Questions addressed by the project:

The specific aims are to:

- Identify and characterise food grade cultures with EPS, polyol antimicrobial and antifungal-producing properties
- Develop natural bio-engineered fibre-based ingredients and food products capable of releasing functional bioactive compounds
- Develop a range of next generation foods with superior nutritional, health and techno-functional properties
- Evaluate the digestibility, bioavailability, bio-accessibility and bioactivity of food compounds and ingredients within the food matrix
- Demonstrate retention of health promoting activity following gastric transit, based on ex vivo studies to assess prebiotic activity and bioavailability/digestibility

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3. The experimental studies:

We aimed at creating step-change in how premium fermented foods are developed, using innovative processes for transforming food substrates (milk, cereals, and meat) into fermentates, using novel strains of lactic acid bacteria (LAB) and yeasts to produce value-added fermented liquids and powders and long-fermented sourdough bread with improved health benefits, organoleptic qualities and extended shelf-life. Based on pre-selection of starter bacteria capable of producing bioactive metabolites (exopolysaccharides, polyols and antimicrobial compounds) and their use during fermentation of milk, cereals and meat, the fermentation process was optimised by manipulating processing conditions to optimise food properties for health and economic benefit. Characteristics such as digestibility, palatability, stability and quality of the finished products were assessed to ensure development of highly marketable products.

4. Main results:

Food grade strains were isolated from a range of food and environmental sources and characterised (selected on basis of bio- and techno- functional characteristics) and tested for safety including antibiotic resistance, biogenic amine and toxin production. Using selected cultures, we then developed a range of fermented foods with improved health benefits, organoleptic qualities and extended shelf-life.

5. Opportunity/Benefit:

The outputs from Longlife have demonstrated how the unique phenotypic traits of a number of bacterial species can be exploited for the benefit of the AgriFood sector and therefore add to the bank of ever expanding scientific knowledgein the area of natural preservatives and health promoting bacteria to improve the food we eat. The publications arising from these studies add weight to further funding applications in this area of research. Indeed, this research has already leveraged additional funding in both Ireland and New Zealand and it is anticipated that the research outputs will be taken up by end users in both countries and potentially new international partners.

6. Dissemination:

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