

PhD: Food Science 40th cycle

Title: Development of the production process for probiotic Buffalo milk Ice Cream and Soft Cheese, as new functional foods

Supervisor: Prof. Raffaele Romano (AGR/15)

Co-Supervisor: Prof. Maria Aponte (AGR/16)

Objectives of the research project and interdisciplinary collaborations:

Buffalo milk represents 15% of worldwide milk production and is an important source of bioactive compounds. The Mediterranean region offers a sizable market for buffalo milk dairy products like Mozzarella di Bufala Campana. About 41,000 tons of Mozzarella di Bufala Campana PDO (Protected Designation of Origin) were produced in Italy in 2015, and that number only approached 56,000 tons in 2022. Such a humble increase is likely the result of shifting consumer expectations regarding food, which is now viewed as a key component of health maintenance. Consequently, there has been an increasing turn towards the development of functional foods able to provide valuable health benefits. In light of this, the project's goal is to develop dairy products enhanced with probiotics and perhaps prebiotics, such as ice cream and soft spreadable cheese made from buffalo milk. Furthermore, a comparison will be made between the conventional ice cream production process and alternative techniques, like the use of anhydrous bases and mixes of lyophilized ingredients that need to be reconstituted. Following this, the characterization of the obtained products will be carried out. Specifically, analytical methods including HPLC-DAD, HPLC-MS, GC-MS, and GC-FID will be used to identify nutritional compounds and bioactive molecules. Along with evaluating the survival of the probiotic strains, the stability, and functionality of the bioactive compounds will be assessed throughout the production stages, as well as during the shelf-life of the novel foods.

Innovation and originality of the project in relation to the state of the art:

The first innovative element of the project is to expand the range of available products made with buffalo milk by developing probiotic and symbiotic products with potential health properties combined with the nutritional assets typical of buffalo milk, such as high protein, fat, and vitamin content coupled with low cholesterol content. The second key aspect of the project will be the study and characterization of possible bioactive peptides released in buffalo milk through the integration of probiotic microorganisms. The use of alternative ingredients, such as pre-fermented components from bacteriocin-producing microorganisms with antimicrobial activity, is another foreseen feature. Ultimately, in addition to their bioactive chemical content, the impact of the technological processes employed will be evaluated regarding the rheological, textural, and sensory properties of the newly generated functional foods.

Grant availability:

- 1- "Cartoni ondulati idonei per il contatto con Alimenti, rivestiti Superficialmente con coating Ecocompatibili, biodegradabili e compostabili a base di pectine e Sieroproteine-CASES"

- CDS001058, CUP: C77B23000070005. Bando D.M. 09/12/2014, MISE-Soggetto proponente: DiA. Approvato con DR/2024/154 del 17/01/2024. Soggetto proponente: DiA, assegnati: 1266,954k€. Durata 4 anni.
- 2- “Succo di pomodoro probiotico - PROBIODORO” CDS000821, CUP: C77J22000030008 nell’ambito del Contratto di Sviluppo “Pomato”. Bando D.M. 09/12/2014, MISE, Approvato con DR/2024/155 del 17/01/2024. Soggetto proponente: DiA. Assegnati: 1486,38 k€. Durata 4 anni.
- 3- Dolce e Salato - NUTRA LIFE FOODS - Accordo di sviluppo Invitalia SPA. ”, finanziato dal MISE, CUP C79122000600001 e approvato con Decreto rettorale DR/2023/1147 del 30/03/2023. Soggetto proponente: DiA. Assegnati: 452,93 k€. Durata 4 anni.

Collaborations with foreign institutions:

- Faculty of Pharmacy, Laboratory of Food Chemistry and Toxicology, University of Valencia, Av. Vicent Andrés Estellés s/n, 46100 Burjassot, Spain.

Dopazo, V., Luz, C., Quiles, J. M., Calpe, J., Romano, R., Mañes, J., & Meca, G. (2022). Potential application of lactic acid bacteria in the biopreservation of red grape from mycotoxigenic fungi. *Journal of the Science of Food and Agriculture*, 102(3), 898-907.

Luz, C., Quiles, J. M., Romano, R., Blaiotta, G., Rodríguez, L., & Meca, G. (2021). Application of whey of Mozzarella di Bufala Campana fermented by lactic acid bacteria as a bread biopreservative agent. *International Journal of Food Science & Technology*, 56(9), 4585-4593.

Luz, C., D'Opazo, V., Quiles, J. M., Romano, R., Mañes, J., & Meca, G. (2020). Biopreservation of tomatoes using fermented media by lactic acid bacteria. *Lwt*, 130, 109618.

Luz, C., Rodriguez, L., Romano, R., Mañes, J., & Meca, G. (2020). A natural strategy to improve the shelf life of the loaf bread against toxigenic fungi: The employment of fermented whey powder. *International journal of dairy technology*, 73(1), 88-97.

Manzo, N., Santini, A., Pizzolongo, F., Aiello, A., Marrazzo, A., Meca, G., Durazzo, A., Lucarini, M., & Romano, R. (2019). Influence of ripening on chemical characteristics of a traditional Italian cheese: Provolone del Monaco. *Sustainability*, 11(9), 2520.

- Department of Food Science, School of Biosciences, University of Nottingham: Nottingham, Nottinghamshire, GB;

Sacchi, R., Paduano, A., Caporaso, N., Picariello, G., Romano, R., & Addeo, F. (2018). Assessment of milk fat content in fat blends by ¹³C NMR spectroscopy analysis of butyrate. *Food Control*, 91, 231-236.

- Hannah Dairy Research Foundation, Scotland