**Valorisation of dairy production in inland areas: product and process innovation**

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The project aims at innovating the realization of dairy products in the inland areas of Molise, respecting their tradition. After a careful analysis of raw materials and production processes, innovative products will be developed using ingredients, also from the territory, containing bioactive compounds, to increase their health/nutritional value.

**Valorizzazione delle produzioni lattiero-casearie delle aree interne: innovazione di prodotto e di processo**

Il progetto ha come obiettivo l’innovazione delle produzioni lattiero-casearie delle aree interne del Molise, nel rispetto della loro tradizione. Dopo un’analisi accurata delle materie prime e dei processi di produzione, verranno sviluppati prodotti innovativi mediante l’utilizzo di ingredienti, anche provenienti dal territorio, contenenti composti bioattivi, al fine di incrementarne il valore salutistico/nutrizionale.

# **1. State-of-the-Art**

The proposed research topic is the enhancement of dairy production in inner areas of Molise. In this regional economy, the dairy sector represents one of the most consolidated ones, perfectly connected with the artisan dairy tradition and the consistency of the dairy cattle herd (about 12500 heads in 2020). Due to the link of the supply chain to the production, the Molise dairy system is based on the model of typical productions, whose specificity is the result of multiple factors. The "typicality" factor tends to be inherent in the origin of the product, or rather, in the presence of a link between product and territory, which is recognized in the origin of the raw material and/or in the location of the processing activities. However, strengths, represented by tradition, have to face difficulties in the agricultural conversion, in improving the quality of products and/or innovation in well-defined sectors and the empiricism of traditional technologies. The collaboration between the world of research and the industrial production led to a product/process innovation that allowed having food that combine the right quality/price ratio and high nutritional standards, in safety. It should be added that the traditional agri-food products are evolving towards new proposals (packaging, service, characterization) to meet the new needs of consumers. For example, innovative biodegradable packaging/coatings, especially those carrying antimicrobial agents, were proved to extend shelf life of cheese without having a negative impact on sensory properties (Jafarzadeh *et al*, 2021). Re-evaluating and promoting the traditional productions, through targeted research actions adapted to the size of the company, becomes very important to answer to the new needs of the European market and, at the same time, support the competitive advantage of these productions. The PhD project aims at broadening the qualitative dimension of the company productions, through technological and organizational transformations, fully consistent with the development objectives of the "National Strategy for the Inner Areas of the Country" (National Strategy for Inner Areas, 2013). The project proposal aims at increasing the competitiveness of the dairy sector of the inland areas of the Alto Medio Sannio. This will be done through the valorisation of the local dairy productions and the development of tools and methodologies, also characterized by innovation, able to ensure the enhancement of the quality and safety of dairy products of excellence, with a clear territorial identity, and to promote a policy of synergy and efficiency of the entire agri-food chain. For example, adding ingredients from the agriculture and the territory, rich in healthy compounds, could lead to an improvement of the nutritional value of the dairy products, encouraging the circular economy and generating a sustainable and healthy production (Picciotti *et al*, 2022). Another way to innovate could be the use of milk from different origin. The development of appropriate technologies for the production of innovative cheeses, using a mixture of cow and ewe or goat milk, could be an interesting and feasible opportunity for the dairy industry (Niro *et al*, 2014). Traditional dairy productions, if appropriately enhanced/innovated in compliance with the needs of the market and the consumers, can play an important social role, helping to maintain not only stable traditions, but also farms, rural population and local production, processing, marketing and enogastronomic tourism companies.

# **2. PhD Thesis Objectives and Milestones**

Within the overall objective mentioned above, this PhD thesis project can be subdivided into the following activities, according to the Gantt diagram given in Table 1:

1. **Bibliographic research** and evaluation of the state of the art.
2. **Characterization of pastures/forages, starting milk and products,** through chemical-nutritional and technological analysis to evaluate the quality of raw materials and products (A2.1) and *shelf-life* tests (A2.2) to determine the durability of the dairy products. Study/evaluation of product/process indicators.
3. **Evaluation/optimization of the processes and packaging**, through the evaluation/optimization of process parameters (A3.1) and new packaging methods (A3.2) that could improve the durability of the products. Study/evaluation of product/process indicators.
4. **Development of traditional/innovative products** with new formulations that can include ingredients from the territory (A4.1) and evaluation/optimization of process parameters to obtain the innovative dairy products (A4.2). Study/evaluation of product/process indicators.
5. **Characterization of innovative traditional products,** through chemical, physical, sensorial, safety of use, nutritional and functional evaluation (A5.1) and *shelf- life* tests (A5.2) to determine the durability of the innovative products. Study/evaluation of product/process indicators.
6. **Writing and Editing** of the PhD thesis, scientific papers and oral and/or poster communications.

***Table 1***Gantt diagram for this PhD thesis project.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Activity Months | | **2** | **4** | **6** | **8** | **10** | **12** | **14** | **16** | **18** | **20** | **22** | **24** | **26** | **28** | **30** | **32** | **34** | **36** |
| A1) | ***Bibliographic research*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A2) | ***Characterization of pastures/ forages/ starting milk and products*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1) Chemical-nutritional and technological analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2) *Shelf-life* tests |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A3) | ***Evaluation/optimization of the processes and packaging*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1) Evaluation of process parameters |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2) Evaluation of new packaging methods |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A4) | ***Development of traditional/innovative products*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1) Formulations of innovative products |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2) Optimization of processes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A5) | ***Characterization of innovative made products*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 1) Chemical-physical, sensory, sanitary, nutritional and functional evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 2) *Shelf-life* test |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A6) | ***Thesis and Paper Preparation*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# **3. Selected References**

Jafarzadeh, S., Salehabadi, A., Nafchi, A. M., Oladzadabbasabadi, N., & Jafari, S. M. (2021). Cheese packaging by edible coatings and biodegradable nanocomposites; improvement in shelf life, physicochemical and sensory properties*.* *Trends in Food Science & Technology*, **116**, 218-231.

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