EMBOCHEESE: development of a new concept for formed cheese and the ripening process

Summary

The dairy sector is a strategic sector in the Catalan agrifood industry, due to both its economic importance and its contribution to the development and attachment of the rural population, which has been in a crisis since the end of the dairy quotas system, leading to the closure, transformation and diversification of several companies in the sector.

The increase in the demand for locally produced, high-quality innovative products means that dairy companies are considering developing new products to add value to milk and open up new markets for sales, both in Spain and internationally.

At present, cheeses can have various shapes depending on the mould that the curd is placed in for ripening. These are usually round, cylindrical or square, but there are also other shapes, such as a bag. In Italy, the production of some cheeses involves the shaping, ageing and ripening process being carried out while the cheese is hanging off the ground.

MONTBRÚ, a livestock farming company and producer of goat's milk and dairy products in the Moianès region, has gone a step further in the development of innovative products. Taking the idea for processing a cured meat sausage, MONTBRÚ aims to innovate in its system for ripening cheese, which uses the packing technique (the shape and drying system for cured sausages) to make the cheese it produces maintain or improve its sensory and nutritional characteristics when compared to a cheese ripened according to the current production system.

In order to bring this product to market, a number of activities were carried out to develop/improve the manufacturing technology and the ripening system of a product that is obtained using forming technology. Various casings and alginates adapted to these types of product were also used in order to pack the cheese curd.

The project also worked using non-invasive techniques to monitor the ripening of the cheeses. These techniques are increasingly widely used by agrifood companies to classify products without having to destroy them. The best known technique is NIR, which requires analysis of a specific pattern curve for the product. This technique was used to determine the product's moisture and water activity (WA) during its ripening process, enabling it to be monitored and the technological conditions to be adjusted depending on the development of the product. The aim is to improve the ripening process to obtain a uniform final product in all batches.

Objectives

This project aims to create new and innovative high quality cheeses bound with string, with the texture and taste of large format ripened cheeses, with a shorter ripening time, and to obtain new markets and business channels for the dairy sector.

The specific objectives set out in this project are:

- Development of new and innovative cheeses bound with string

- Development of new casings for packing cheese curd
- Development of alginates as a material for packing cheese curd
- Development of moisture checks in the process using a portable NIR spectrometer

The intrinsic aims are:

- Shorter ripening times of the cheese, with the consequent reduction in energy consumption by the ripening chambers
- Reduced handling of cheese during the ripening process
- Diversification of the cheese producers' business with no need for a large investment
- Added value for livestock farming and cheese production establishments
- Introduction of sensor technology for process quality control in the cheese industry
- Obtain results transferable to the traditional dairy sector

Description of the actions carried out in the project

Activity 1. Physicochemical and microbiological classification of the raw material and the finished product.

Physicochemical classification (fat, protein, lactose, dry extract, a_w and pH) and microbiological classification (total aerobes, enterobacteria, coliforms, *Listeria monocytogenes, Staphylococcus* and *E. coli*) of the raw material (goat's milk, finished product and cheese produced according to the forming technology) at different times of the year.

Activity 2. Cheese production process with packing technology.

Task 2.1. Pilot plant tests: Forming cheese with casings and alginate

A pilot plant test was performed to adapt the forming protocol with alginates. Various types of concentrations were tested to find the optimal mould for the cheese curd.

Task 2.2. Industrial testing: Production of formed cheese with casings and alginate

Four industrial tests for the production of formed cheese with casings and alginate were carried out. Various types of forming machinery, different types of casings and two types of salted cheese were included.

Activity 3. Cheese ripening process and monitoring of ripening chambers.

Task 3.1. MONTBRÚ technical advice on ripening chambers

Two ripening chambers were monitored to determine the temperature and humidity conditions and to propose actions for optimising and homogenising the ripening of the production batches.

Task 3.2. Ripening of the cheese and monitoring

The cheeses produced in activity 2.2 were placed in the ripening chambers. Initially, the first production batch was ripened at the IRTA and MONTBRÚ facilities to confirm that both ripening processes were carried out correctly. The ripening in the three subsequent production processes took place only at MONTBRÚ.

Visual and sensory analysis was performed in each production batch to determine which machinery, casing and salting provided the best results for scheduling the next production, and to rule out those that did not provide such satisfactory results.

While the project was under way, a new activity was proposed to improve the cheese's shelf life and prevent the excessive drying that it may experience after it enters the marketing circuit due to spending time in cold stores after it has been shipped from the Montbrú facilities. Tests were carried out with various containers and concentrations of gases inside them for both formed cheese formats (small and XXL). Gas, visual and sensory analysis was performed for seven consecutive weeks to check the packaging was operating correctly.

Activity 4. Assessment of the finished product and consumer study.

Task 4.1. Quality control of the finished product

The shelf life was studied 4 at sampling points in the final industrial production process (beginning cold store (t_0), 2 intermediate checks (t_2 and t_3) and the end of the shelf life (t_4)). The shelf life study was performed for both the small formed cheese and the XXL formed cheese.

Physicochemical checks (dry extract, a_w and pH), microbiological checks (total aerobes, enterobacteria, coliforms, *Listeria monocytogenes, Staphylococcus and E. coli*), and sensory analysis will be performed at each sampling time.

Task 4.2. Consumer study

A consumer study was scheduled, involving 100 people who tasted the two formed cheeses (small and XXL) and a third traditional round cheese, in order to determine their perception and acceptance of the innovative product(s). The tasting was blind, and the samples were cut into square pieces so that the consumer's perception was not influenced. A product acceptability test was performed with and without the packaging to complete the study.

Activity 5. Product control by portable NIR technology.

The cheeses were sampled at different weeks in the ripening process in order to create a calibration curve to determine the moisture content of the cheese with portable NIR technology. The initial aim described in the project report was to determine the humidity using NIR technology. Determination of the WA of the final product was also considered useful. At the same time, humidity and WA analyses were performed using traditional methodology to adjust the equipment and confirm that it was in correct working order.

After the calibration curve for the cheese had been obtained, its operation with industrial-scale production was confirmed.

Activity 6. Dissemination

The following dissemination activities were carried out during the project:

- Four dissemination seminars for trainees
- 1 technical webinar: "Innovations in the dairy sector", 15 September 2021
- Various actions on the members' websites and social networks
- GO EMBOCHEESE informative video explaining the aim of the project, the results obtained and the opinion of the members
- 2 press releases
- Publications in various magazines and newspapers
- Radio interview

Final results and practical recommendations

The results and practical recommendations are listed below.

- The tests carried out with the alginate forming process identified the need to continue working on the mechanisation of the process in order to obtain more homogeneous formed cheeses.
- The casings must permit some degree of permeability to moisture if the product is to ripen correctly. A high level of permeability in the casing leads to drier cheeses. Very thick casings do not permit a suitable exchange of moisture between the inside of the cheese and the outside
- Automatic piston forming machinery produces cheeses with a texture that is more homogeneous and less granular
- Cheeses formed with worm drive machinery during the ripening process, have slightly higher moisture levels than those formed with pistons or blades
- The process for making formed cheeses involves effective hygiene practices with good microbiological results in the finished product and during its shelf life
- The packaging of the final product in MAP or vacuum packaging maintains acceptable sensory characteristics until the third week after packaging. Continued work on tests with different types of material and gases to increase the shelf life is recommended.
- In the consumer study, more than 50% of consumers said that the cheeses had the right smell, taste and creaminess

- In the assessment of products with packaging in the consumer study, the small formed cheese was more widely accepted, and considered more innovative and more hygienic
- In the assessment of products without packaging in the consumer study, a traditional round product was more highly rated
- Determination of moisture and WA using NIR technology makes monitoring the ripening process easier

Conclusions

The main aim of GO EMBOCHEESE, the development of new innovative cheeses, was achieved. The project worked with various alternatives for casing, machinery and salting, seeking a better quality of process and end product.

The different types of casing may lead to a wide range of formed cheeses in the near future. This is a wide-ranging field, and it is possible to continue working with different sizes (e.g. larger formats), and to incorporate condiments.

The technology of the forming machinery may affect the texture of the end product.

Optimising the checks in the ripening chambers is an important stage in the production process to obtain cheeses with high sensory and visual quality.

The packaging protects the product from excessive drying. Further research in this area may lead to a longer shelf life.

In the consumer study, the products presented were deemed acceptable and with the appropriate levels of taste intensity, smell and creaminess. The packaging of the small formed cheese was rated very positively, while the packaging of the larger format was rated less highly. The packaging of the latter can be adapted to increase its acceptability and consumers' willingness to purchase it. Very clear labelling is required on the outside of the product identifying it as a cheese to avoid confusion with a meat product.

NIR technology is a resource that can be implemented in the future in ripening checks in these new cheeses as well as in other types and formats of cheese. This is an area for work in the future.

The dissemination activities carried out attracted a great deal of interest from the media, the sector and the training area. Innovation in the dairy sector is an area with great potential for further work.

Leader of the Operational Group

ORGANISATION: FORMATGERIES MONTBRÚ, SA
CONTACT E-MAIL: info@montbru.com

Coordinator of the Operational Group

ORGANISATION: IRTA
CONTACT E-MAIL: info@irta.cat

Other members of the Operational Group (grant recipients)

ORGANISATION: FIBRAN, SA
CONTACT E-MAIL: info@fibrangroup.net
ORGANISATION: EDIBLE CASINGS, SL
CONTACT E-MAIL: info@fibrangroup.net

Subject area(s) of application

☒ Food quality/processing and nutrition

Geographical area(s) of application

PROVINCE(S): All
REGION(S): All

Dissemination of the project: publications, seminars, multimedia, etc. (State links)

- Online technical seminar: "Innovations in the dairy sector", 15 September 2021
- News report on the IRTA website: https://www.irta.cat/ca/un-nou-formatge-amb-forma-dembotit-una-innovacio-de-lirta-montbru-i-fibran-group/
- GO EMBOCHEESE information video: https://www.youtube.com/watch?v=0TkbK1jgwfw&t=15s

More information on the project

PROJECT DATES	TOTAL BUDGET
Starting date: July 2019	Total budget: €177,020.00
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	Own funding: €50,100.00

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