Deliverable title	**D5.6 Recommendations and guidelines on manufacturing and authentication of high-value and safe Mediterranean thistle-curdled cheeses**
Deliverable Lead:	CREA-AN
Related Work Package:	**WP5 Cheese-making trials and characterization of thistle-curdled and control cheeses**
Related Task:	Task 5.1 – 5.5
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Dissemination level	Public
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Start date of project	**01.05.2019**
Duration	36 months (after project end extension: 48 months)
Abstract	Based on the outcomes from tasks 5.1 (Cheese-making trials), 5.2 (Physico-chemical and chemical analyses), 5.3 (Microbiological analyses), 5.4 (Textural and sensory analyses), 5.5 (Analysis of nutritionally valuable, health-beneficial and hazardous substances), and 5.6 (Statistical elaboration of data), recommendations and guidelines on manufacturing and authentication of high-value and safe Mediterranean thistle-curdled cheeses have been collected.

Versioning and Contribution History

Version	Date	Modified by	Modification reason
v 1.0	25/05/2022	Pamela Manzi	First version
v 3.0	21/02/2023	Antonio Raffo	Comments after peer reviewing process
v 4.0	27/04/2023	Antonio Raffo	Final version

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Acronyms

CF: Caciofiore
F: Feta
QMV: Queso de Murcia al Vino
TDC: Torta del Casar
CH: Cynara humilis
OT: Onopordum tauricum
OP: Onopordum platylepis
St: spontaneous flowers
Ct: cultivated flowers
AR: Animal rennet
VR: Vegetable rennet, commercial

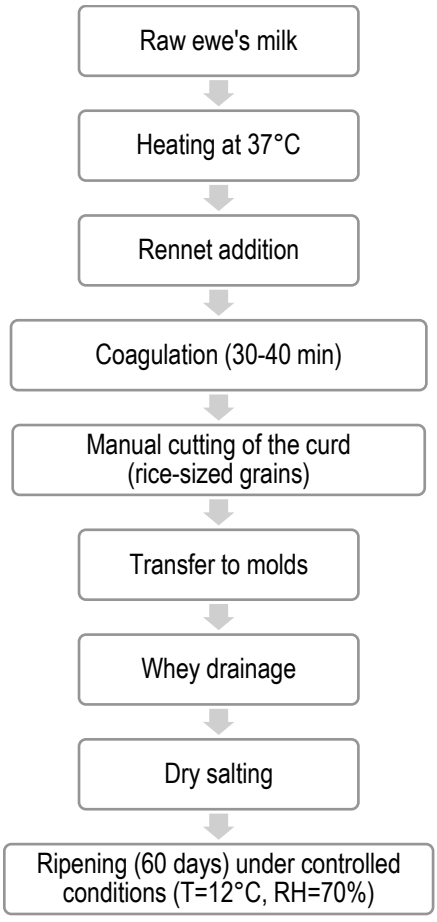
1. General recommendation and guidelines

Based on the overall results collected within the Work Package 5 (WP5), it is possible to highlight some key points on the use of the new thistle-based extracts for cheese manufacture:

- When using freeze-dried powder as milk coagulant, it is essential to re-dissolve in water before adding to the milk. Use microbiologically pure and soft water;
- The choice of the type of extract (species) and the amount to be used as milk coagulant depend on the process parameters of cheese production, so it is not possible to generalize the conditions of its use to a generic cheese production process; in particular, the heating temperature of the milk, the addition of starter cultures simultaneous with the addition of rennet (and subsequent lowering of the pH) and the addition of calcium chloride are the main factors that can affect the action of proteases and accelerate or slow down their activity;
- As an ingredient added to the production process, thistle-based rennet must be safe;
- The use of vegetable rennet is particularly common in the production of traditional cheeses; these cheeses are often made from raw milk and without the addition of starter cultures; control of the hygienic quality of the milk, compliance with the appropriate process parameters, and observance of good hygiene practices are recommended to ensure the safety of these products.

2. Caciofiore cheese

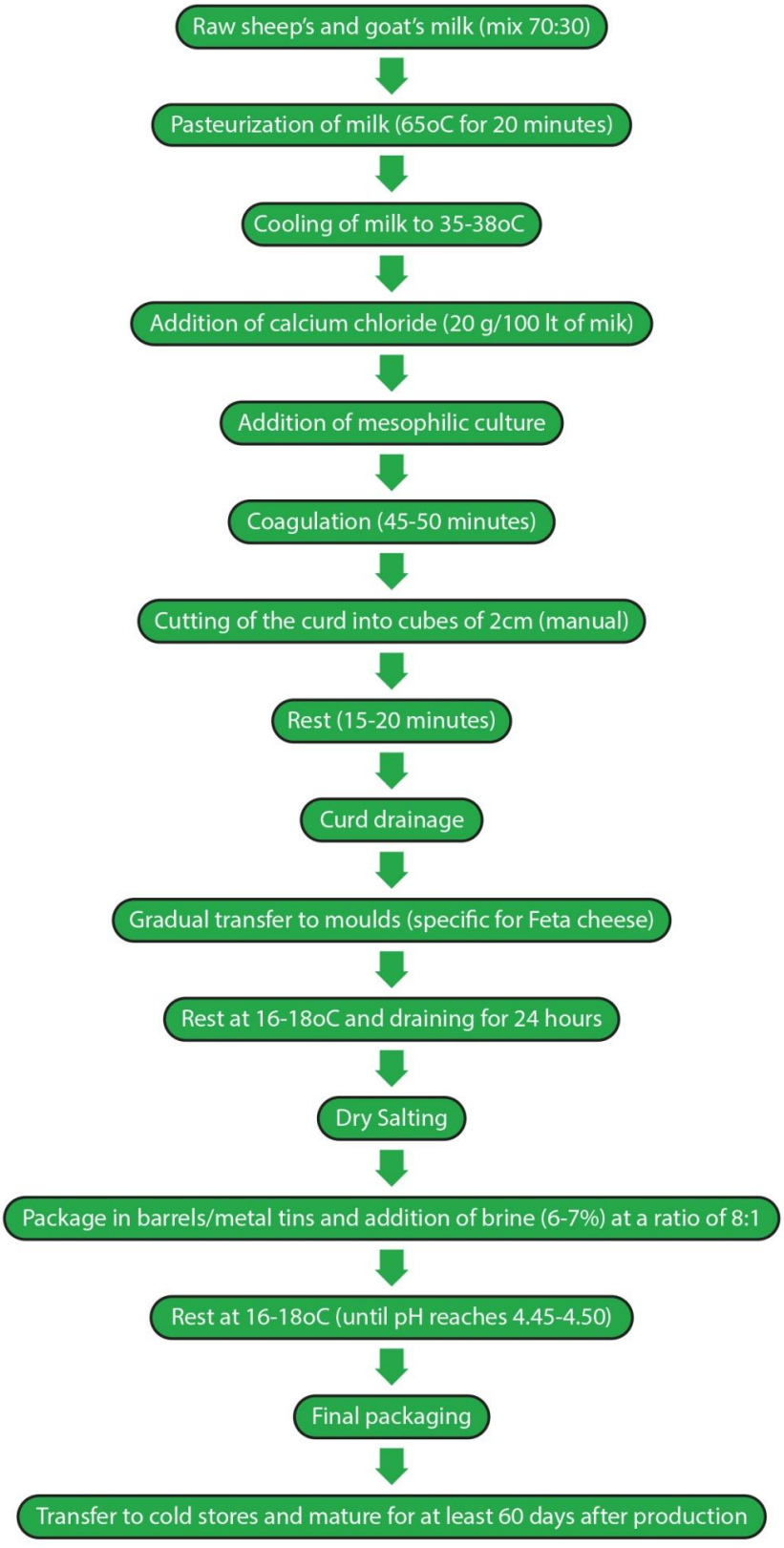
The following figure shows the flow chart of the manufacturing process of Caciofiore cheese.



Good results have been obtained using both extracts from *Onopordum tauricum* and *Onopordum platylepis* from spontaneous and cultivated flowers. Hence, the use of these species for the manufacture of Caciofiore and similar ewe's milk cheeses is suggested.

3. Feta cheese

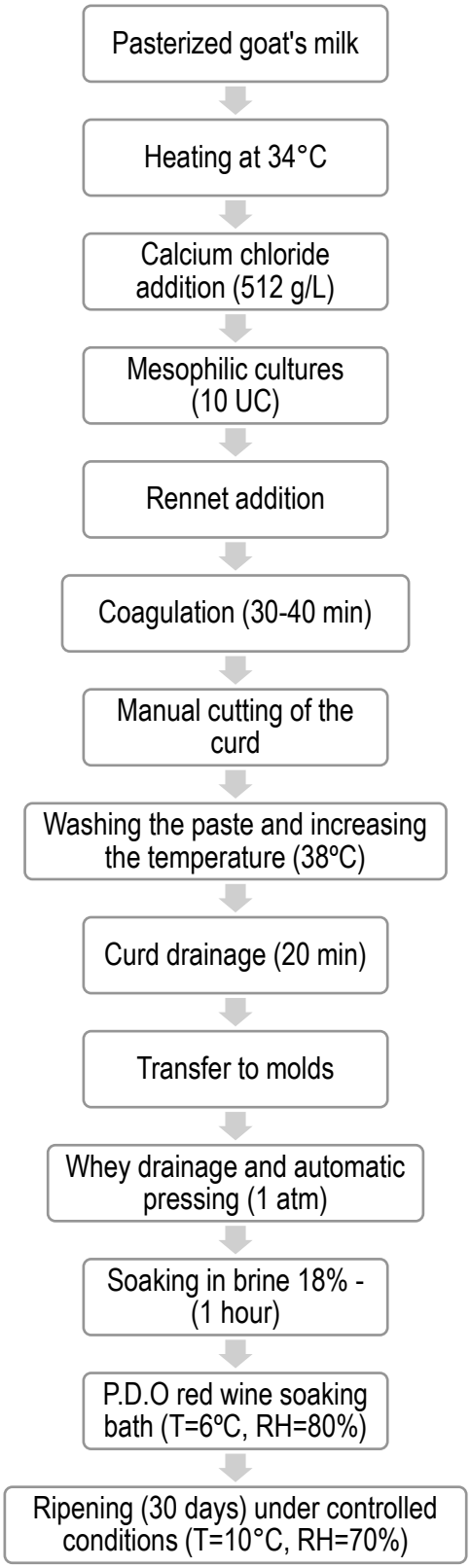
The following figure shows the flow chart of the Feta cheese manufacturing process.



Good results have been obtained with the use of thistle-based rennet extracted from spontaneous and cultivated flowers of *Cynara humilis*. The use of thistle-based rennet for Feta production is a novelty, and the similarity of results between the experimental cheeses and control manufactured with animal rennet, makes the use of the new coagulants promising.

4. Queso de Murcia al Vino cheese

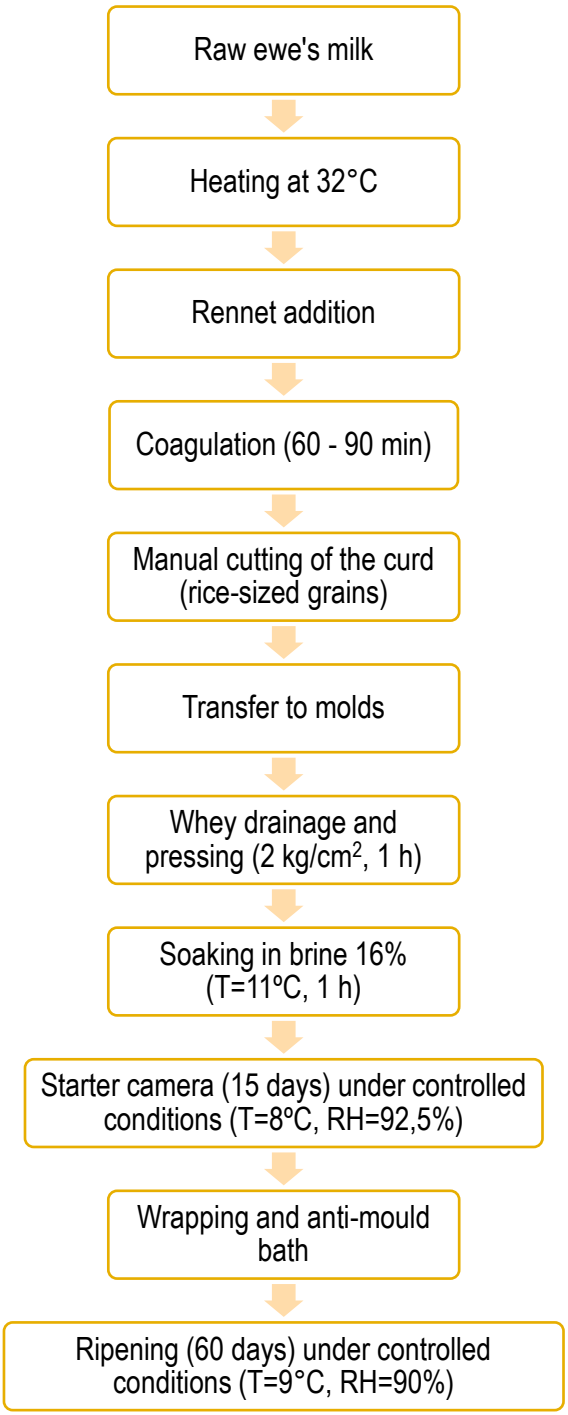
The following figure shows the flow chart of Queso de Murcia al Vino cheese.



The use of extracts from spontaneous *Onopordum platylepis* flowers for the production of Queso de Murcia al Vino cheese was found to be not suitable. The amount used did not allow the coagulation time established in the product specification (PDO) to be observed; increasing the concentration of coagulant in the milk might be able to satisfy the coagulation time, but this could lead to darkening the color of the paste, an attribute considered as a defect in this type of cheese, characterized by a typically white color.
The use of extracts from spontaneous and cultivated *Cynara humilis* flowers showed better results.

5. Torta del Casar cheese

The following figure shows the flow chart of the manufacturing process of Torta del Casar cheese.



The use of extracts from spontaneous and cultivated flowers of *Cynara humilis* was found to be suitable for the production of Torta del Casar.