Coagulation kinetics of sheep milk from Alentejo: a study with cardoon flower extract and cymosin rennet

S. Gomes[1,2*], I. Pina[3], J. Fernandes[4], J. Dias[2,3], F. Reboredo[2,4], A.P.L. Martins[1,2], N. Alvarenga[1,2]

[1]Technology & Innovation Unit (UTI)- INIAV, Oeiras, Portugal; [2]GeoBioTec - NOVA School of Science and Technology, Caparica, Portugal; [3]Polytechnic Institute of Beja - School of Agriculture, Beja, Portugal; [4]NOVA School of Science and Technology, Caparica, Portugal

*Corresponding author: sandra.gomes@iniav.pt

ESTIG/IPB BRAGANÇA, PT
INTERNATIONAL CONFERENCE ON SUSTAINABLE FOODS
Achieving the Sustainable Development Goals
July 24 25 2024

BCheeSE
CYNARATEC

Objectives

Evaluation and comparison of the kinetics of sheep milk coagulation, using 2 types of coagulants:

1 - Cardoon flower extract (*Cynara cardunculus* L.);

2 - Synthetic chymosin rennet (*Kluyveromyces lactis*).

Introduction

Milk coagulation is the essential step in the cheesemaking process.

Preparations of aspartic proteases from *Cynara cardunculus* L. flower extracts.

Microbial (*K. lactis)* and vegetable (*Cynara cardunculus* L.) coagulants.

Differences can be important for cheese properties, which are defined as early as milk coagulation.

Materials and Methods

Milk Samples

Condtions:

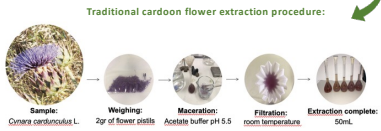
- Whole sheep milk with no heat treatment;
- 28 samples of sheep milk from the Alentejo region, Portugal;
- Stored at - 80ºC (until the date of each analysis);
- Defrosted and heated at 32ºC in controlled water bath, for assays.

Coagulants

Coagulant 1:

Vegetable coagulant extracted from *Cynara cardunculus* L. flower pistils (2:50).

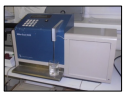
Traditional cardoon flower extraction procedure:



Coagulant 2:

Fermentation-produced chymosin preparation (1:50). (Maxiren DS coagulant, DSM Gist-Brocades, 2600 MA Delft, The Netherlands)

Physical-chemical milk properties



Fat, Protein, Lactose, Total Solids and Non Fat Solids.

Milkoscan 133B (Foss Electric, HillerØd, Denmark)

pH and Acidity of milk.

Potentiometer and milk titration (NP-470, 1983)

Coagulation

Evaluation of the Enzymatic Activity.

(Adapted from IDF 199 / ISO 23058: 2006)

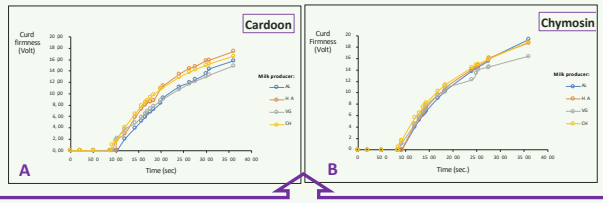
Monitoring of enzymatic coagulation - Optigraph.

(Alves *et al.*, 2004; Martins et al., 2009).

This study aligns with SDG 9 and SDG 12 by exploring cardoon flower extracts as an innovative alternative coagulant in cheese production, fostering sustainability in agricultural practices and promoting responsible consumption patterns and by investigating sustainable alternatives to rennet coagulants, it aims to minimize environmental impact in cheese production.

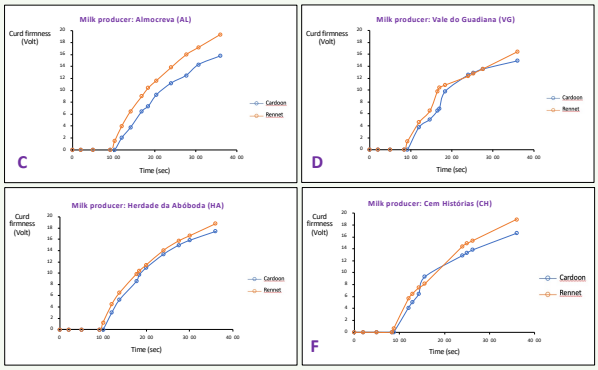
Results

1) Evolution of the Optigraph curd firmness measurement for the 4 milk producers, using cardoon flower extract (Fig. A) **and chymosin rennet** (Fig. B) **as coagulant agents.**



The cardoon flower extract demonstrates higher variability when compared to chymosin rennet.

2) Linear graphs relating the Optigraph curd firmness measurement (volt) for both coagulants used (cardoon and chymosin), for each milk producer. (Fig. C to F)



Conclusions

- The use of cardoon flower extract demonstrates a higher variability when compared to the use of chymosin rennet (Fig. A and B);

  The nature of the coagulant influences milk coagulation properties of sheep milk.

- Lower firmness for cardoon produced curds is evident in ALL milk producers (Fig. C to F) ;

  Related to the higher non-specific proteolytic activity of cardoon aspartic proteases.

- Although clotting time and curd properties can be related to the coagulant specificity, other factors, like milk properties and composition, can affect these measurements and this can be observed when we consider the variability on monitoring the curd evolution.

This highlights the need to control the different technological factors involved in the coagulation process and which will have a further effect on the cheese quality.

Acknowledgements: This work was financially supported by: CynaraTec—Transferência de TeCnologia para Valorização do Cardo (ALT20-03-0246-FEDER-000067) and BCheeSE – Integrated management of production organization for ensuring traceability, authenticity, and valorization of the Serra da Estrela cheese supply chain – Training (PRR-C05-i03-I- 000168). Funding for this work was also obtained by Fundação para a Ciência e a Tecnologia, I.P. (FCT), Portugal, through the research unit UIDB/04035/2020 (GeoBioTec – Research Center)

Bragança, July 24th and 25th of 2024