

PROTEOLYTIC PEPTIDES AS MOLECULAR MARKERS OF QUALITY IN FONTINA PDO CHEESE TYPICALLY PRODUCED IN AOSTA VALLEY MOUNTAIN PASTURES

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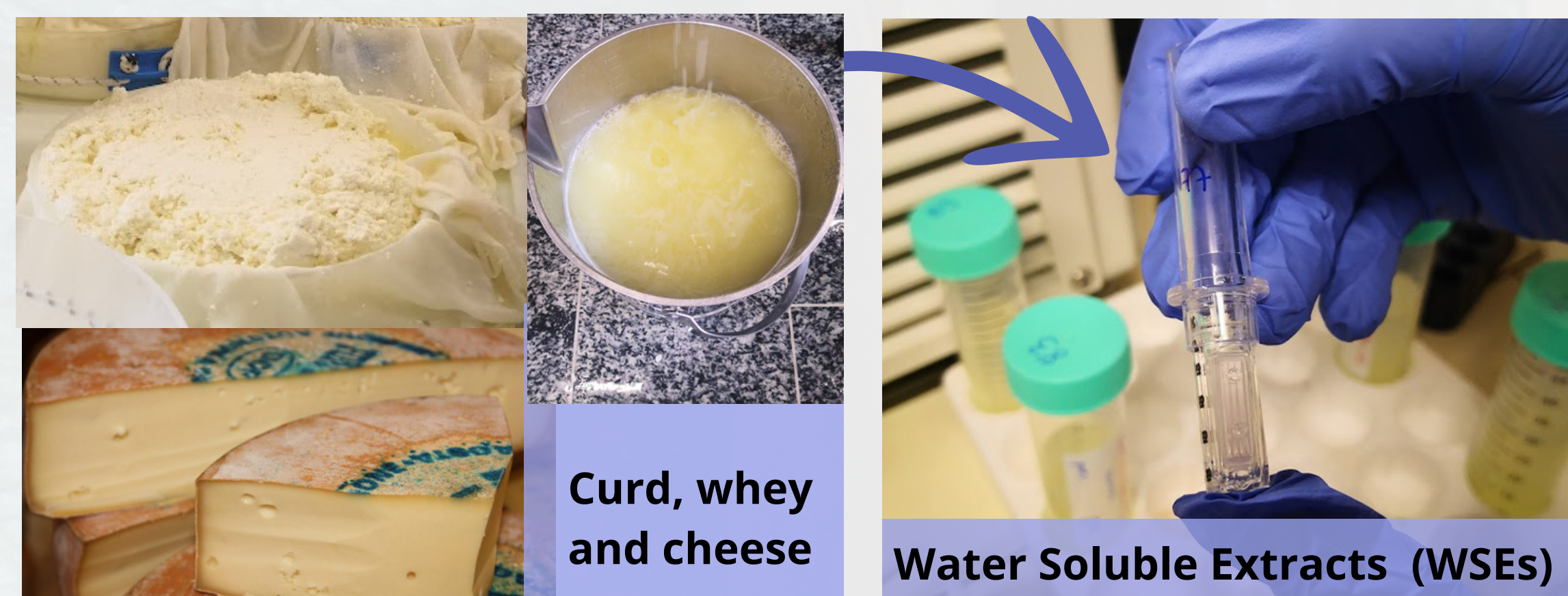
Introduction

Fontina PDO is a semi-cooked cheese, typically produced in Aosta Valley (North West of Italy), made from whole raw milk of autochthonous cattle breeds (Red Pied, Black Pied, and Chesnut) and strains selected in this mountain region and ripened for at least 80 days on wooden shelves.

During the aging process of the cheese, caseins undergo degradation by endoproteases and exoproteases presents in raw milk, in the rennet and released by starter LAB and lactic acid bacteria naturally presents in milk (NSLAB). This important biochemical process, called proteolysis, produces peptides and free amino acids (FAA) that can have an important role as bioactive peptides promoting human health, as kokumi peptides contributing to the aroma profile and as biomarkers for quality and authenticity of PDO cheese.

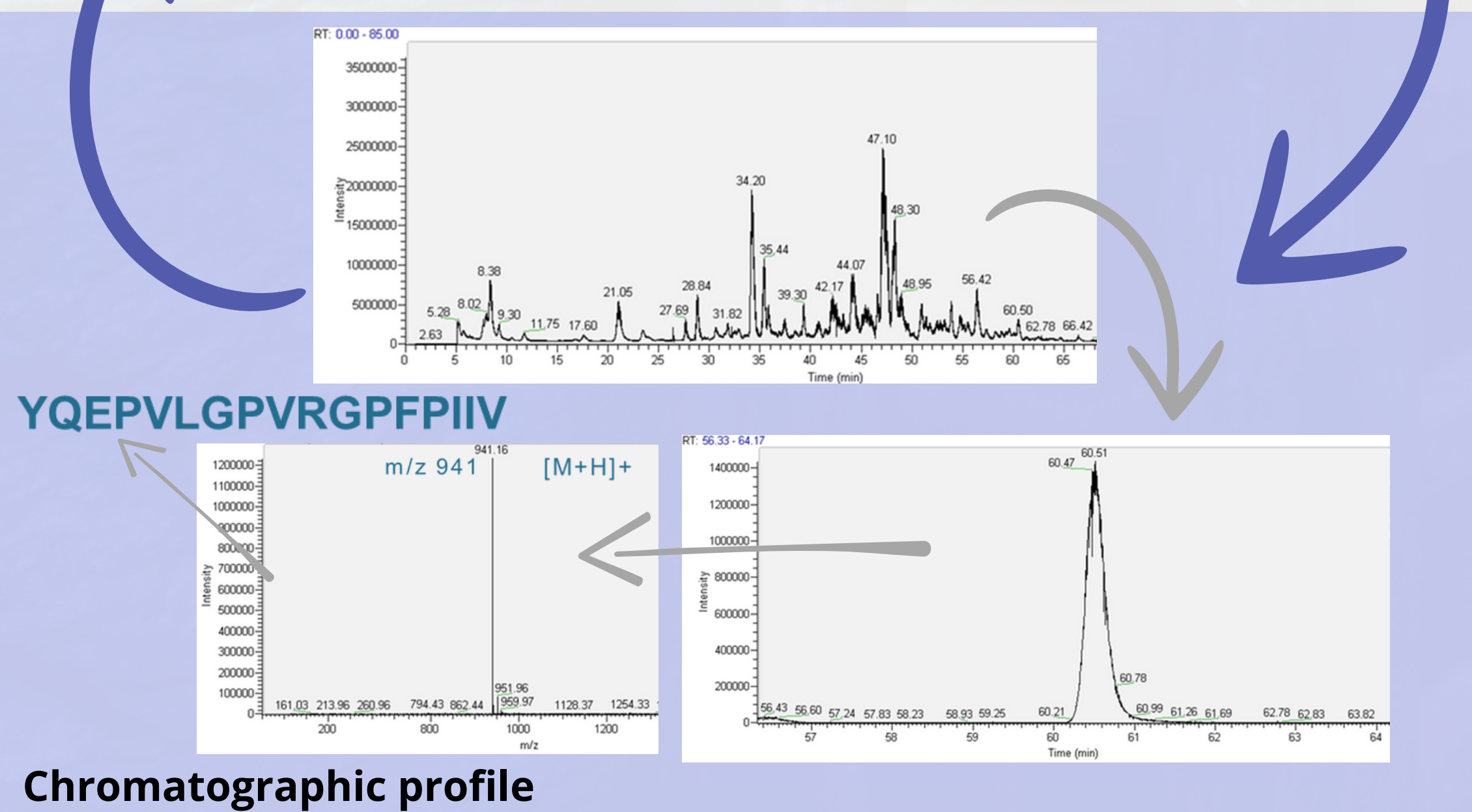
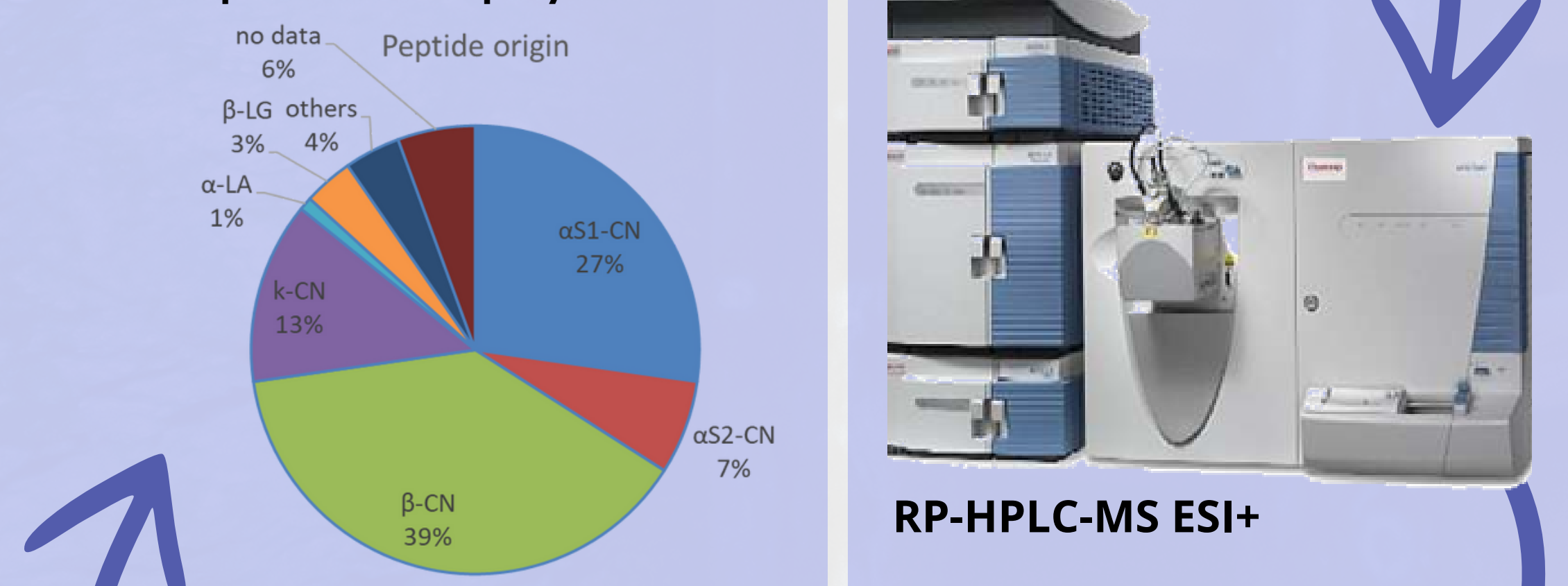
Material and methods

A total of 18 samples were analyzed in triplicate: curd, Fontina 48h, 60 days, 90 days (crust and undercrust) and draining whey produced in three Aosta Valley alpine pastures located above 2000mt altitude.



Data analysis

AHTPDB, Uniprot, MBPDB, ExPASy, literature



Aim of the study

The identification of peptides that typically accumulate in a specific cheese during maturation allows for a better understanding of the maturing process and, therefore, it allows acting on the various stages of production in order to improve the quality of the finished product. This knowledge can also potentially be very useful in ensuring the authenticity of a cheese, particularly those whose quality is related to a specific environment of origin, as Fontina PDO cheese.



Aim of this work was to characterize proteolytic peptides during ripening of Fontina PDO cheese produced in Aosta Valley alpine pastures, in order to put in evidence those peptides to be use as molecular markers of cheese quality.

Results

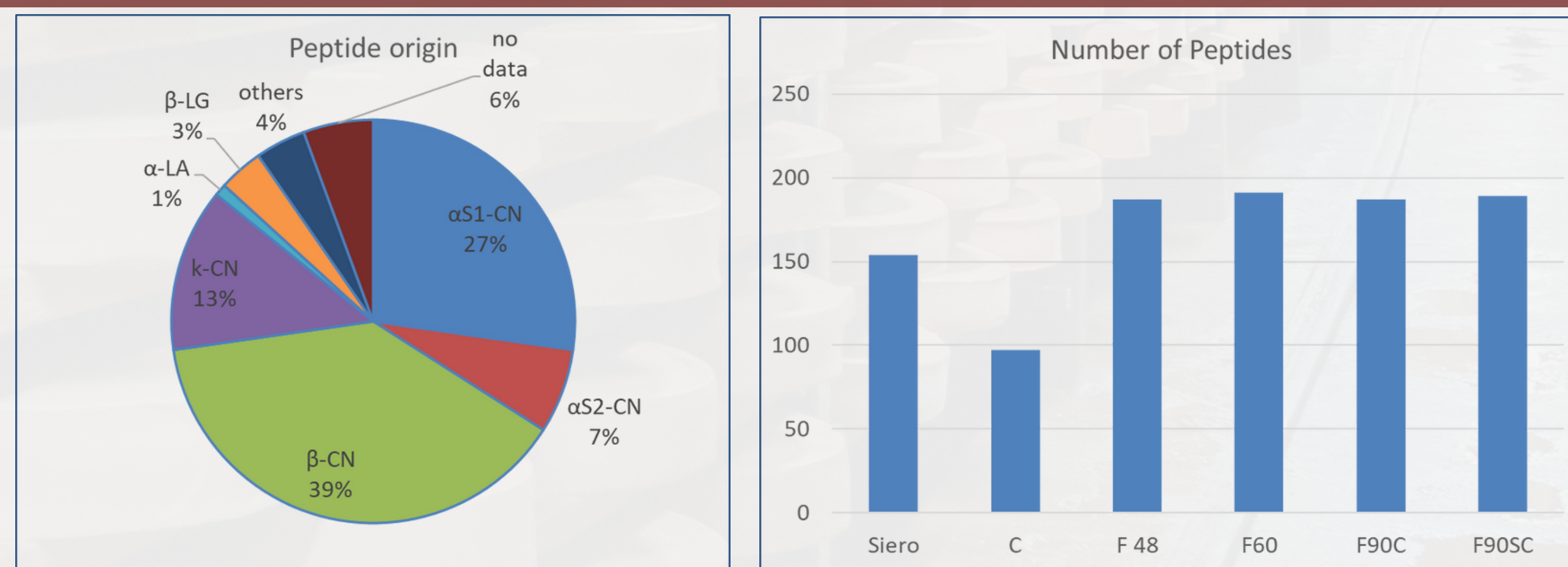


Fig. 1 - Peptides' origin

Fig. 2 - Number of peptides found in different ripening stages

- 419 peptides found of which 85% have been identified
- Most of the peptides identified come from a S1-CN and β-CN (Fig. 1)
- The number of peptides increases considerably during the first 48 hours, and their type varies thereafter
- 3% of the peptides remain intact from the curd to the finished product
- Other peptides are characteristic of each step of maturation
- Most of the **bioactive peptides** found are known to have ACE inhibitory activity (Table 1)
- Some peptides found can have an influence on **cheese flavour** (kokumi peptides) (Table 1)
- Some peptides can be potentially used as **biomarker** to identify the quality and authenticity of produced cheese (Table 1)
- No differences between mountain pastures have been found

Table 1 - Most interesting quality marker peptides found in Fontina PDO cheese 90 days

Biomarker peptides	Kokumi peptides	Bioactive peptides
m/z - sequence	m/z - sequence	m/z - sequence
1001 - YPFPGPIPN β-CN A2	246 - EV	318 - IW/WL ACE inhibitory
941 - YQEPVLGPVRGPFPIIV Raw milk	261 - EI/EL	375 - PYP ACE inhibitory
860 - QEPVLGVRGPFPIIV Raw milk	279 - EM	379 - DKIHPP ACE inhibitory
745 - WQVLSN Ripening marker	1001 - YPFPGPIPN β-CN	414 - PLW ACE inhibitory
	1041 - YPFPGPIHN β-CN	444 - ARPHPHLSFM Antioxidant

Conclusion

This study has allowed the identification of some potentially interesting peptide. However, further research is recommended to expand the specificity of analyses and accurately identify each peptide. This could lead to a method for verifying the quality, origin and authenticity of Fontina PDO cheese in order to preserve this cheese and its typicality.

Acknowledgements

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