TeRiFiQ

Project no. 289397

Combining Technologies to achieve significant binary Reductions in Sodium, Fat and Sugar content in everyday foods whilst optimizing their nutritional Quality

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Deliverable D1.1

Report on the influence of salt optimisation on lactic acid fermentation in the European main cheeses

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Lead contractor/partner for this deliverable: 2 ACTIA(Actilait)
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Dissemination level	
PU Public (must be available on the website)	[x]
PP Restricted to other programme participants (including the Commission Services)	[ ]
RE Restricted to a group specified by the consortium (including the Commission Services)	[ ]
CO Confidential, only for members of the consortium (including the Commission Services)	[ ]

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1. Summary

1.1 Objectives of the deliverable

The deliverable has for objective to describe the reduction in salt in experimental cheeses, the consequences in terms of fermentation and cheese composition. This deliverable D1.1 was obtained at the end of the task T1.1 (relation between salt-level reductions and fermentation in cheese).

1.2 Main results obtained

The reduction in salt level was from 10 to 30% in function of the possibilities as decided in the definition of work. The composition of cheese and the main parameters of acidification were not modified. In one of the cheese-type studied, the reduction of salt level was not obtained because of specific ripening conditions. The means of reduction and correction will be studied by partners as foreseen in the task T1.4

1.3 Next steps

In consequence, the results concerning the influence of salt on quality, ripening processes (lipolysis and proteolysis (task T1.2)), sensory (texture, aroma and taste (task T1.3)) and functional quality will be studied without any technological bias.

2. Introduction

2.1 Use of salt in cheese production

Cheeses are often salted by brining in salt water or/and by washing during the ripening time with a mix of water, salt and ripening flora. The reduction of salt level in cheese is generally obtained by the reduction of the brining time. The quantity S of salt intake by the cheese is in proportion with the concentration C of salt in brine, the ratio S/V between cheese surface and cheese volume, and the square root t1/2 of the brining time. That is why the reductions of salt level in cheese by -20% and -30% are obtained by reduction of the brining time by -36% and -50%.

2.2 Types of cheeses investigated

We studied 4 types of cheeses: a semi-hard cheese Trappist made in a semi-industrial company (P12), a semi-hard cheese Raclette studied in a model-cheese level (P2), a soft cheese with mould (*Pennicilium camemberti*) Brie studied in a model-cheese level (which was the reference model cheese for the Dream project P2) and a soft cheese ripened with yeasts and bacteria, washed during the ripening time Boû d'Fagne (P7).

2.3 Targets of this first experimental work

a. To check that the modelling of brining time allowed obtaining the desired salt level.

b. To check that the composition of cheese (mainly dry matter and fat) for the control (0% reduction of salt level) and the low-salt trials are the same (Good

reproducibility) except for the salt level in order to allow the comparison between the different cheese.

c. To verify that the lactic acid fermentations in the model cheeses are also comparable.

3. Results and Discussion

3.1 Results in terms of salt reduction in cheeses.

a. In Trappist cheese, the NaCl levels in ripened cheeses were 2% (gNaCl/100gcheese), 1.48% and 1.29% corresponding to the reductions 0%, 26.8% and 36.8% reaching the objective (N=10).

b. In Raclette model cheeses the NaCl contents were (mean, standard-deviation, N=3) 2.32 % (0.06%), 2.06% (0.19%), 1.86% (0.05%) corresponding to the reductions -14% and -29% not far from the objective.

c. In Brie-cheese models the NaCl levels in different trials at the end of ripening were (mean, standard deviation, N=3) : 1.71% (0.13%) ; 1.43 (0.04%) ; 1.31 (0.01%). This corresponds to the reductions: 0% (control), -16% and -24% not far from the target.

d. In Boû d'Fagne (N=10) the NaCl content obtained in the 24 h cheese was 2.1 %, 1.8% and 1.6% corresponding at the objective (0%, -14%, -24%). These reductions were obtained by brining times of 3h, 1h30 and 1h. In this cheese, the NaCl level is not stable during ripening. At the end of ripening D21, the NaCl levels in cheese were modified by the successive washing during maturation. The final NaCl levels in ripened cheeses were: 2.4%, 2.3%, 2.2%, leading to a salt reduction lower than the target. This fact leads the WP1 group to propose the use of NaCl substitutes in washing (KCl solutions for example).

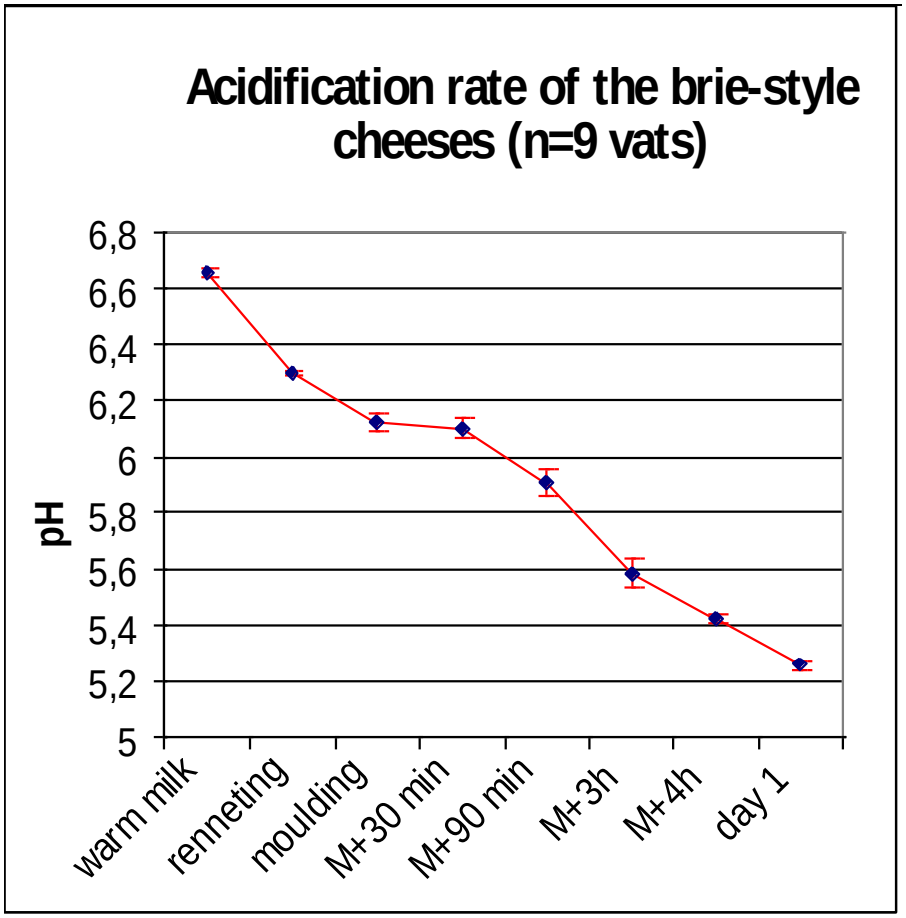
3.2 Results in terms of cheese composition.

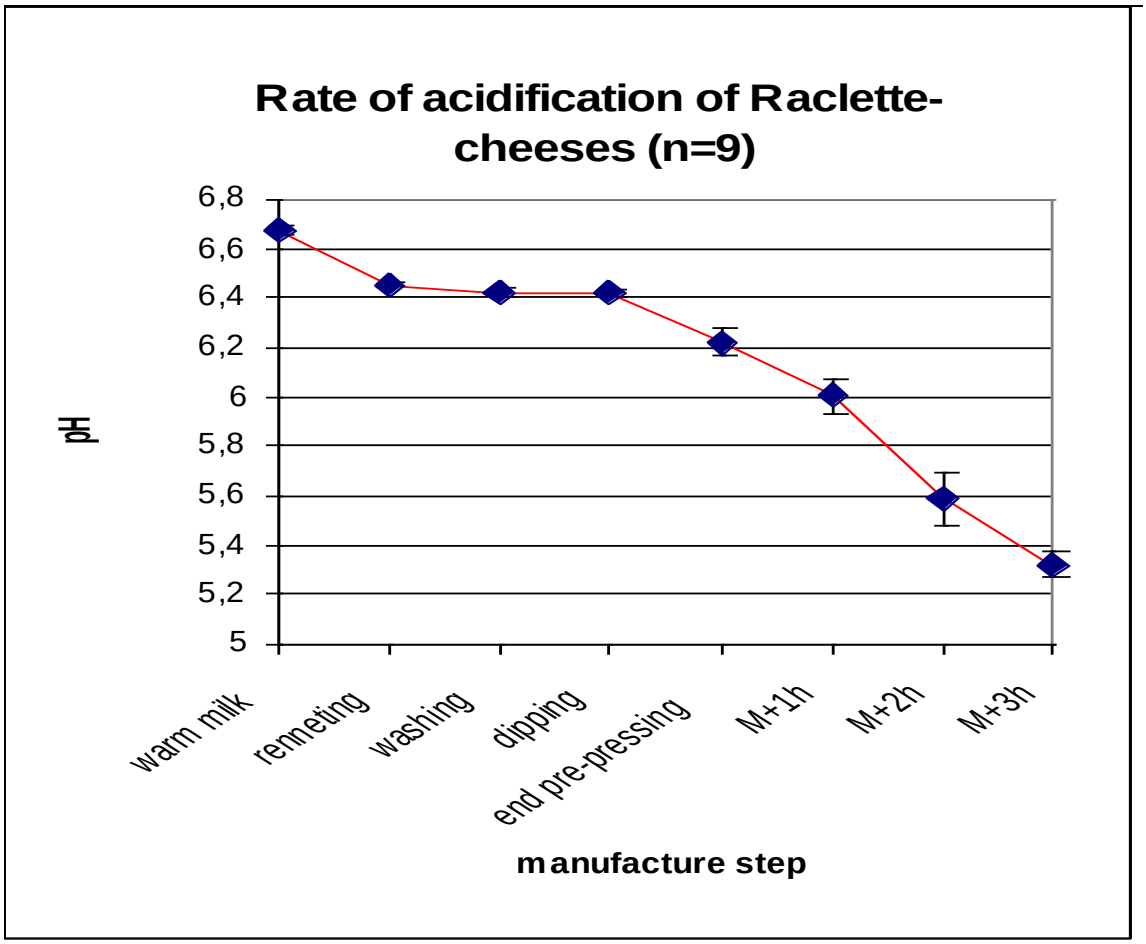
The table below gives the main results in term of cheese composition (Dry matter DM, Moisture in Not Fat Cheese MNFC). These results are very realistic and reproducible and show that the trial cheeses can be statistically compared without technological bias. The difference between trials is always lower than 1%, which is the analytical precision for DM and MNCF.

Salt reduction targets	0%	20%	30%
Trappist DM	61.6%	61.23%	61.21%
Raclette DM	53.9%	53.8%	55.13%
Brie DM	53.0%	52.9%	53.9%
BoutdFagne21 DM	51.8%	52.5%	53.1%
Trappist MNFC	57.9%	58.5%	58.8%
Raclette MNFC	63.2%	63.3%	63.2%
Brie MNFC	69.3%	69.2%	68.6%
BoutdFagne21 MNFC	65.7%	65.1%	65.1%

3.3 Results in terms of lactic fermentation.

There are no differences between cheeses in terms of acidification (transformation of lactose to lactic acid by lactic acid starters). Two detailed examples are given below: pH during acidification time in minutes or hours are given for Brie cheese and Raclette cheese. The vertical bars represent standard-deviation for all the trials.





4. Conclusion

In conclusion we obtained salt (NaCl) reductions of 15-25% and 25-35% in Trappist, Raclette and Brie cheese. The cheeses are comparable in terms of lactose fermentation, dry matter and moisture in not fat cheese.

These technological and statistical facts allow comparing the ripening processes (proteolysis and lipolysis) and the final quality (sensory analysis for texture, aroma and taste) of low fat cheeses to those of control cheeses that will be described in deliverables D1.2 and D1.3.

In the case of the smear washed soft cheese-type Boû d'Fagne, the desired NaCl reduction was obtained for D1 cheese (-14% and -24%). The trial cheeses are comparable. But due to washing during ripening this salt reduction is limited by this ripening operation to 10% at the Day 21.

Firstly, in agreement to the Description of Work of the task 1.4 the WP1 group propose to use salt replacers (for example KCl) for washing the cheese.

Secondly, the WP1 group is waiting for the results of the ripening process (lipolysis and proteolysis) and final quality for the salt reduced Boû d'Fagne cheeses (even though the reduction is lower than desired) before proposing corrections as described in the Definition of Work of task 1.4.

5. References

JR Kerjean, R Richoux (2003) Manuel du Salage en Fromagerie, Editions Arilait, Paris, 69 pages

TP Guinee, BT O'Kennedy (2007) Reducing Salt in Cheese and Dairy Spreads in Reducing Salt in Foods: Practical Strategies, Woodhead PTD Ed., London