HOSPITAL VETERINÁRIO
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Medicina Veterinária Equina
COM O APOIO DE:
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14
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INTERNACIONAIS
HOSPITAL VETERINÁRIO
MURALHA DE ÉVORA

PRODUTOS LÁCTEOS OBTIDOS COM LEITE DE PEQUENOS RUMINANTES: DESAFIOS E OPORTUNIDADES PARA O SETOR

Carlos Dias Pereira

Escola Superior
Agrária de Coimbra

SUMÁRIO

1-A problemática dos queijos de ovelha e cabra portugueses com DOP;

2-Valorização de soro e de sorelho: oportunidades para o desenvolvimento de novos produtos;

3-Manteiga e leitelho de ovelha com adição de microrganismos probióticos;

4-Recuperação de energia no processo de fabrico de requeijão.

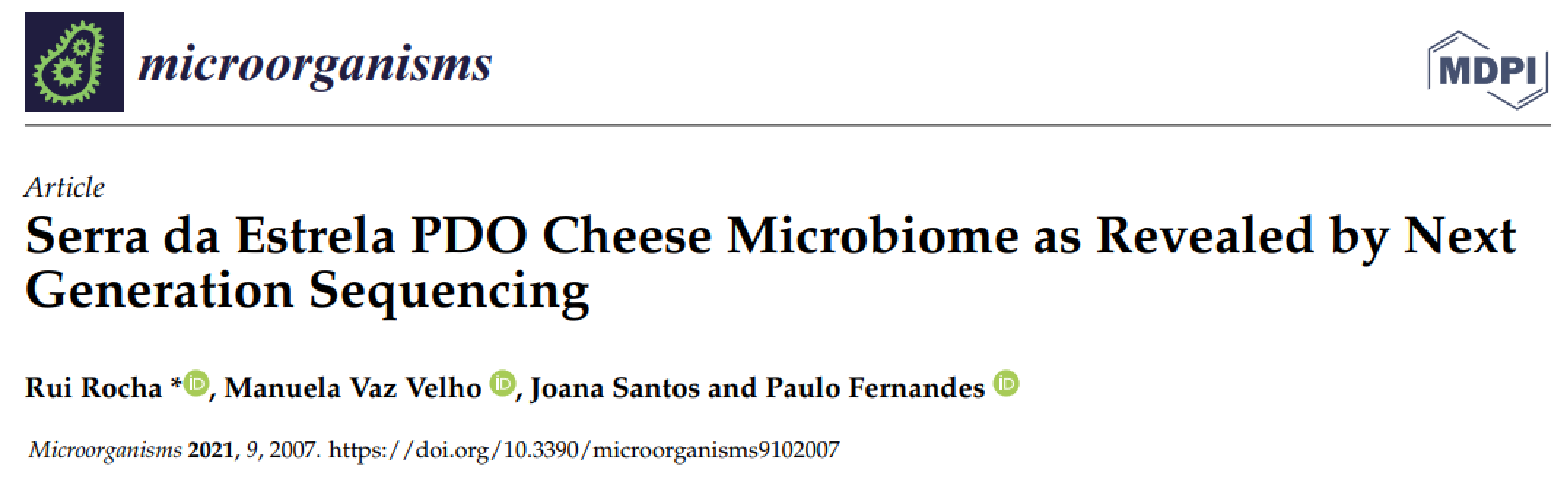
A problemática dos queijos de ovelha e cabra portugueses com DOP

Os queijos com DOP representam uma parcela mínima dos queijos de ovelha e cabra produzidos em Portugal (*ca.* 9% e 1% respetivamente).

QUAIS AS CAUSAS DESTA SITUAÇÃO?

Atualmente não falta informação de excelência sobre as caraterísticas físico-químicas e microbiológicas dos queijos DOP Portugueses (especialmente os produzidos com queijo de ovelha).

QUAIS AS RAZÕES PARA O CONHECIMENTO CIENTÍFICO NÃO SER TRANSFERIDO PARA OS PRODUTORES?



microorganisms

Article

Serra da Estrela PDO Cheese Microbiome as Revealed by Next Generation Sequencing

Rui Rocha *, Manuela Vaz Velho, Joana Santos and Paulo Fernandes

Microorganisms **2021**, *9*, 2007. https://doi.org/10.3390/microorganisms9102007

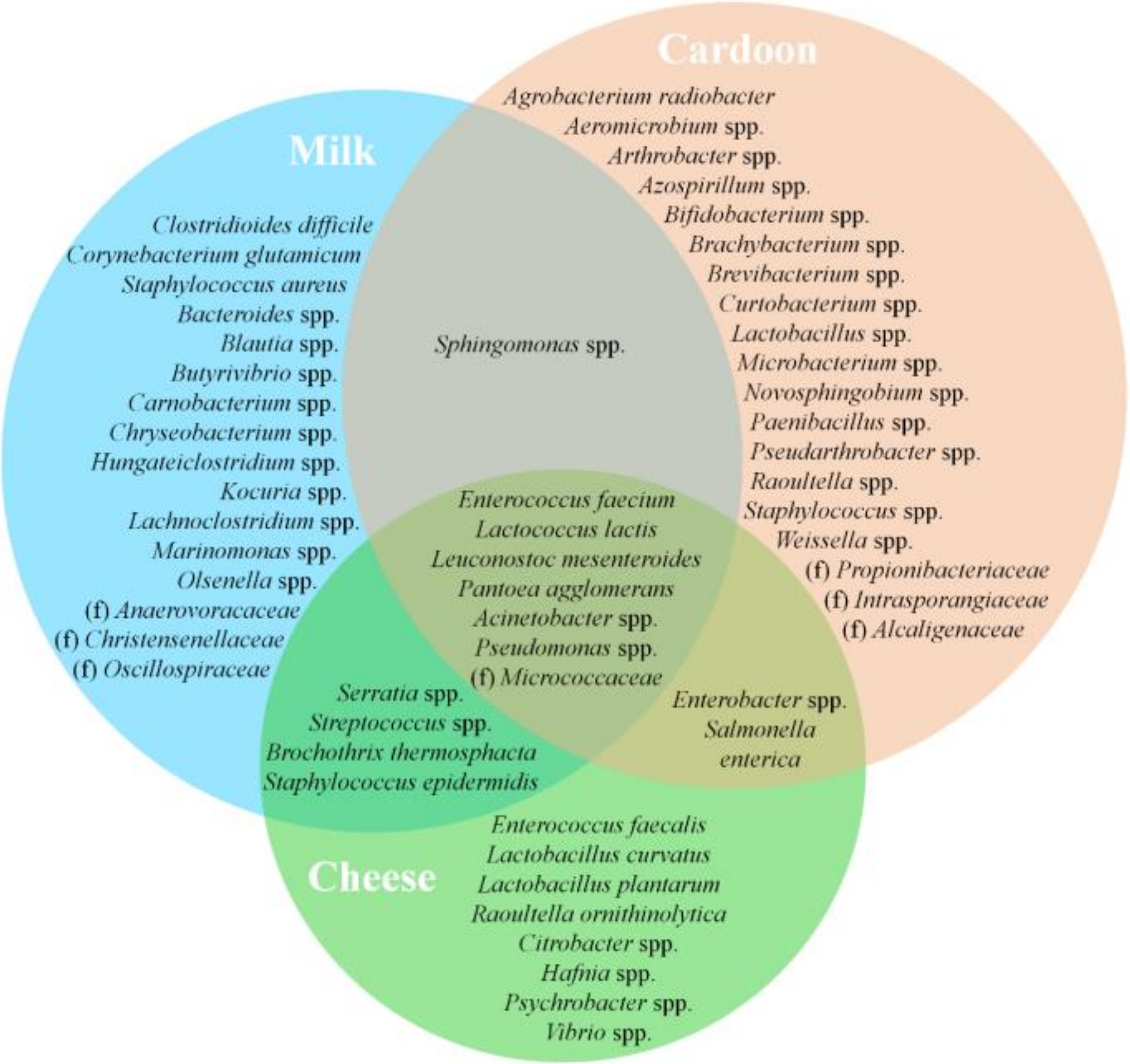

Cardoon
Milk
Cheese
Agrobacterium radiobacter
Aeromicrobium spp.
Arthrobacter spp.
Azospirillum spp.
Bifidobacterium spp.
Brachybacterium spp.
Brevibacterium spp.
Curtobacterium spp.
Lactobacillus spp.
Microbacterium spp.
Novosphingobium spp.
Paenibacillus spp.
Pseudarthrobacter spp.
Raoultella spp.
Staphylococcus spp.
Weissella spp.
(f) Propionibacteriaceae
(f) Intrasporangiaceae
(f) Alcaligenaceae
Clostridioides difficile
Corynebacterium glutamicum
Staphylococcus aureus
Bacteroides spp.
Blautia spp.
Butyrivibrio spp.
Carnobacterium spp.
Chryseobacterium spp.
Hungateiclostridium spp.
Kocuria spp.
Lachnoclostridium spp.
Marinomonas spp.
Olsenella spp.
(f) Anaerovoracaceae
(f) Christensenellaceae
(f) Oscillospiraceae
Sphingomonas spp.
Enterococcus faecium
Lactococcus lactis
Leuconostoc mesenteroides
Pantoea agglomerans
Acinetobacter spp.
Pseudomonas spp.
(f) Micrococcaceae
Serratia spp.
Streptococcus spp.
Brochothrix thermosphacta
Staphylococcus epidermidis
Enterobacter spp.
Salmonella enterica
Enterococcus faecalis
Lactobacillus curvatus
Lactobacillus plantarum
Raoultella ornithinolytica
Citrobacter spp.
Hafnia spp.
Psychrobacter spp.
Vibrio spp.

Figure 9. Venn diagram representing shared core taxa of bacteria between raw ewes' milk (blue area), cardoon (red area) and Serra da Estrela cheese (green area) matrices. f denotes identified bacterial families without taxonomic attribution to genus and/or species.

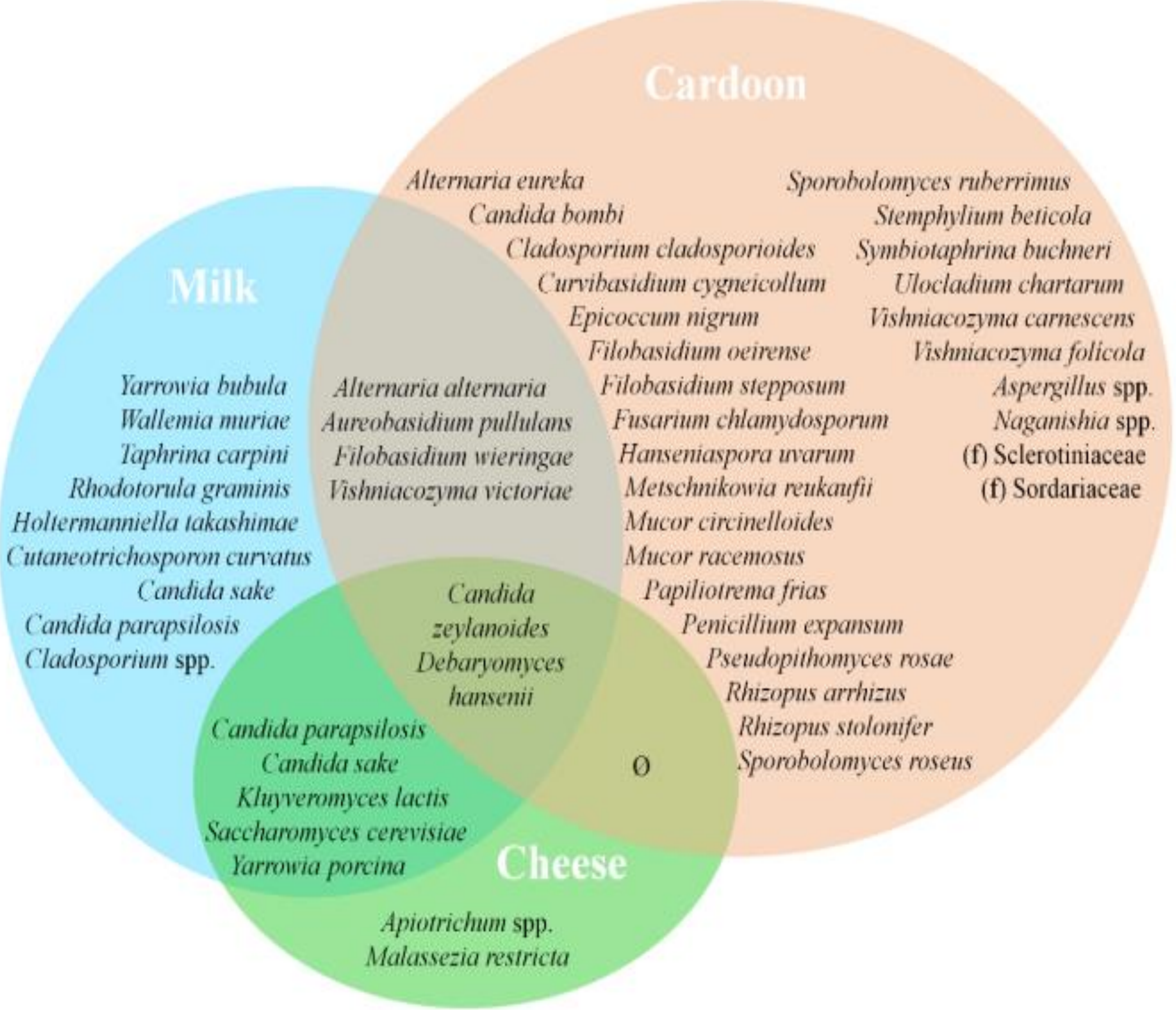
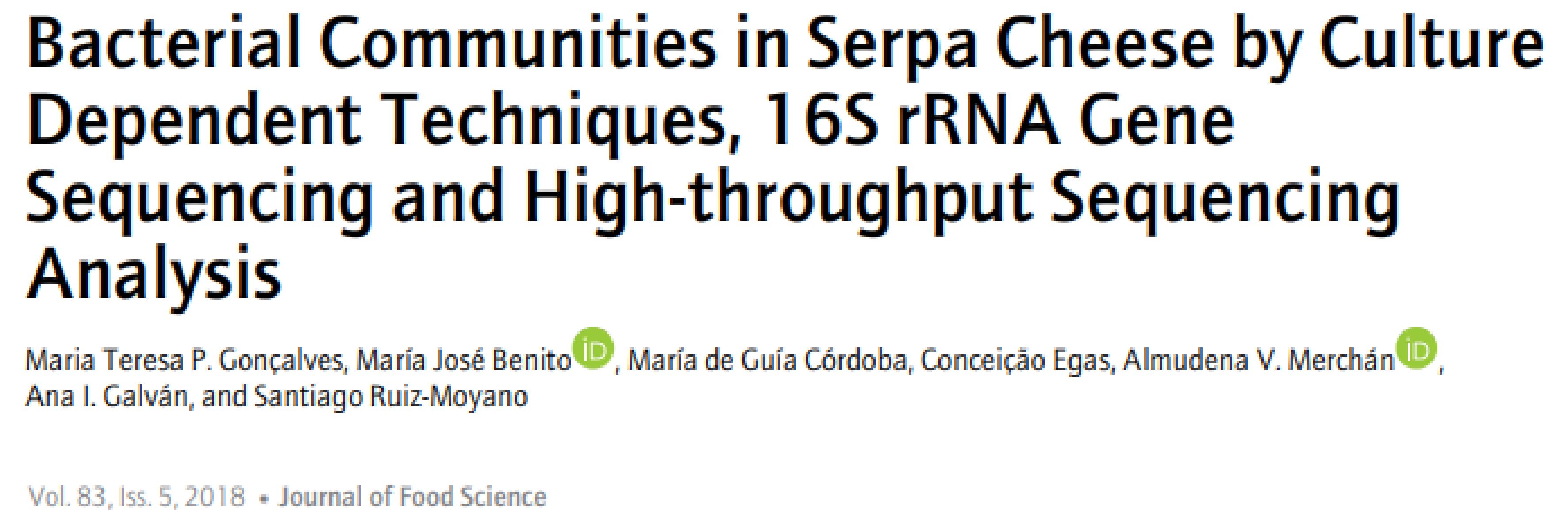

Cardoon
Alternaria eureka
Candida bombi
Cladosporium cladosporioides
Curvibasidium cygneicollum
Epicoccum nigrum
Filobasidium oeirense
Filobasidium stepposum
Fusarium chlamydosporum
Hanseniaspora uvarum
Metschnikowia reukaufii
Mucor circinelloides
Mucor racemosus
Papiliotrema frias
Penicillium expansum
Pseudopithomyces rosae
Rhizopus arrhizus
Rhizopus stolonifer
Sporobolomyces roseus
Sporobolomyces ruberrimus
Stemphylium beticola
Symbiotaphrina buchneri
Ulocladium chartarum
Vishniacozyma carnescens
Vishniacozyma folicola
Aspergillus spp.
Naganishia spp.
(f) Sclerotiniaceae
(f) Sordariaceae
Milk
Yarrowia bubula
Wallemia muriae
Taphrina carpini
Rhodotorula graminis
Holtermanniella takashimae
Cutaneotrichosporon curvatus
Candida sake
Candida parapsilosis
Cladosporium spp.
Alternaria alternaria
Aureobasidium pullulans
Filobasidium wieringae
Vishniacozyma victoriae
Candida zeylanoides
Debaryomyces hansenii
Ø
Candida parapsilosis
Candida sake
Kluyveromyces lactis
Saccharomyces cerevisiae
Yarrowia porcina
Cheese
Apiotrichum spp.
Malassezia restricta

Figure 10. Venn diagram representing shared core taxa of fungi between raw ewes' milk (blue area), cardoon (red area) and Serra da Estrela cheese (green area) matrices. f denotes identified bacterial families without taxonomic attribution to genus and/or species.



Bacterial Communities in Serpa Cheese by Culture Dependent Techniques, 16S rRNA Gene Sequencing and High-throughput Sequencing Analysis

Maria Teresa P. Gonçalves, María José Benito, María de Guía Córdoba, Conceição Egas, Almudena V. Merchán,
Ana I. Galván, and Santiago Ruiz-Moyano

Vol. 83, Iss. 5, 2018 • Journal of Food Science

https://www.serpaflora.com/

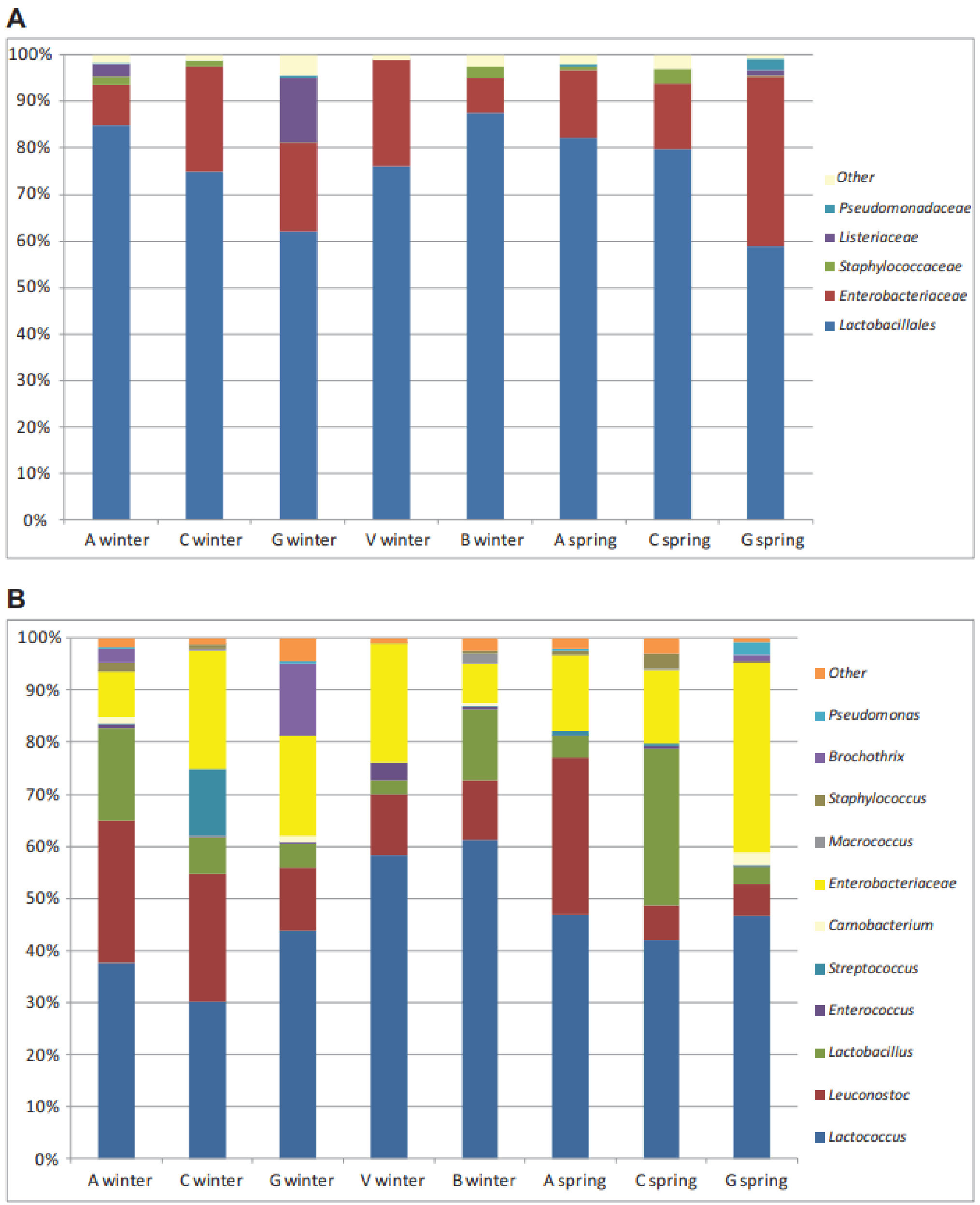
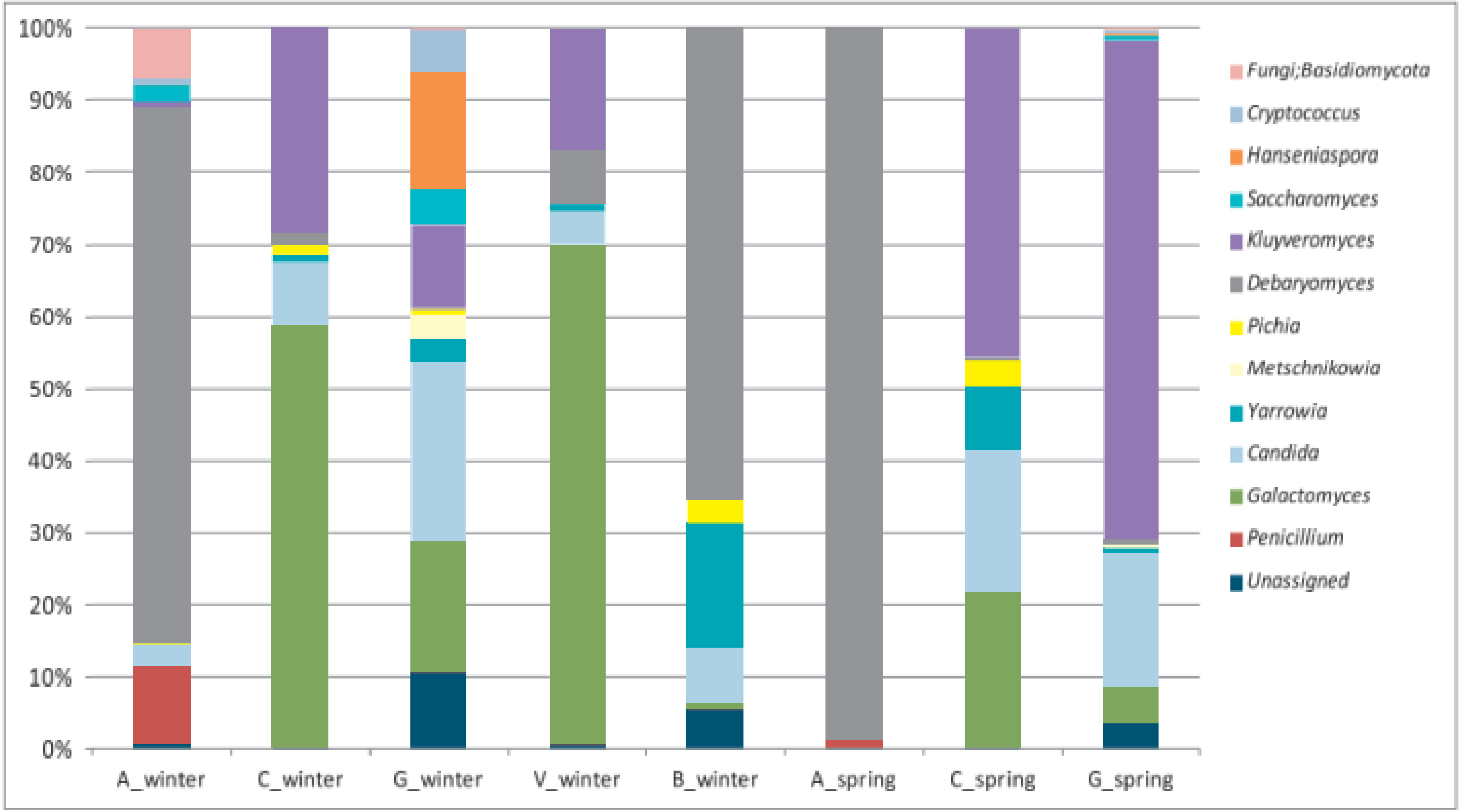


Figure 1 –Mean relative abundance of bacteria in cheeses from different industries (capital letters) analyzed in two different seasons (winter and spring) using high-throughput sequencing of the 16S rRNA gene. (A) at the family level; (B) at the genus level.



100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
A_winter
C_winter
G_winter
V_winter
B_winter
A_spring
C_spring
G_spring
Fungi;Basidiomycota
Cryptococcus
Hanseniaspora
Saccharomyces
Kluyveromyces
Debaryomyces
Pichia
Metschnikowia
Yarrowia
Candida
Galactomyces
Penicillium
Unassigned

SELEÇÃO DE INÓCULOS

foods

MDPI

Article

Impact of LAB from Serpa PDO Cheese in Cheese Models: Towards the Development of an Autochthonous Starter Culture

Helena Araújo-Rodrigues [1], António P. L. Martins [2,3,†], Freni K. Tavaria [1], João Dias [3,4],
Maria Teresa Santos [4], Nuno Alvarenga [2,3] and Manuela E. Pintado [1,*]

Valorização de soro e de sorelho: oportunidades para o desenvolvimento de novos produtos

O soro e o sorelho representam um dos principais desafios/oportunidades do setor dos laticínios.

Em Portugal são produzidas anualmente cerca de 600.000 toneladas de soro, na sua maioria resultantes da produção de queijos de leite de vaca (65.736 ton queijo).

No entanto, a produção de soro e de sorelho resultante do fabrico de queijos de pequenos ruminantes não é negligenciável (11.870 ton queijos de ovelha; 4.221 queijos de cabra e 6.160 ton queijos de mistura).

No caso do soro de queijos de ovelha e cabra, uma parte é utilizada na produção de requeijão.

No entanto, devido aos custos energéticos do processo de fabrico de requeijão e ao curto prazo de validade deste produto, uma parte significativa do soro não é processada.

Por outro lado, do fabrico de requeijão resulta o sorelho que não é aproveitado em alimentação humana e representa um problema ambiental, se descartado sem tratamento adequado.

Valorização de soro e de sorelho: oportunidades para o desenvolvimento de novos produtos

PROCESSOS DE FILTRAÇÃO TANGENCIAL

- Processos de filtração seletiva por membrana sob ação de um gradiente de pressão.

- O líquido de alimentação (A), que circula paralelamente à membrana, é impulsionado por uma bomba que cria o gradiente de pressão (Δp) suficiente para que o filtrado ou permeado (Pe) a atravesse.

- O concentrado ou retido (Re) corresponde à porção de (A) que não atravessa a membrana e, na qual, um ou vários dos seus componentes aumentam de concentração.

- O fluxo de filtração corresponde ao caudal de permeado que passa através de determinada área ($Lh^{-1}\ m^{-2}$).

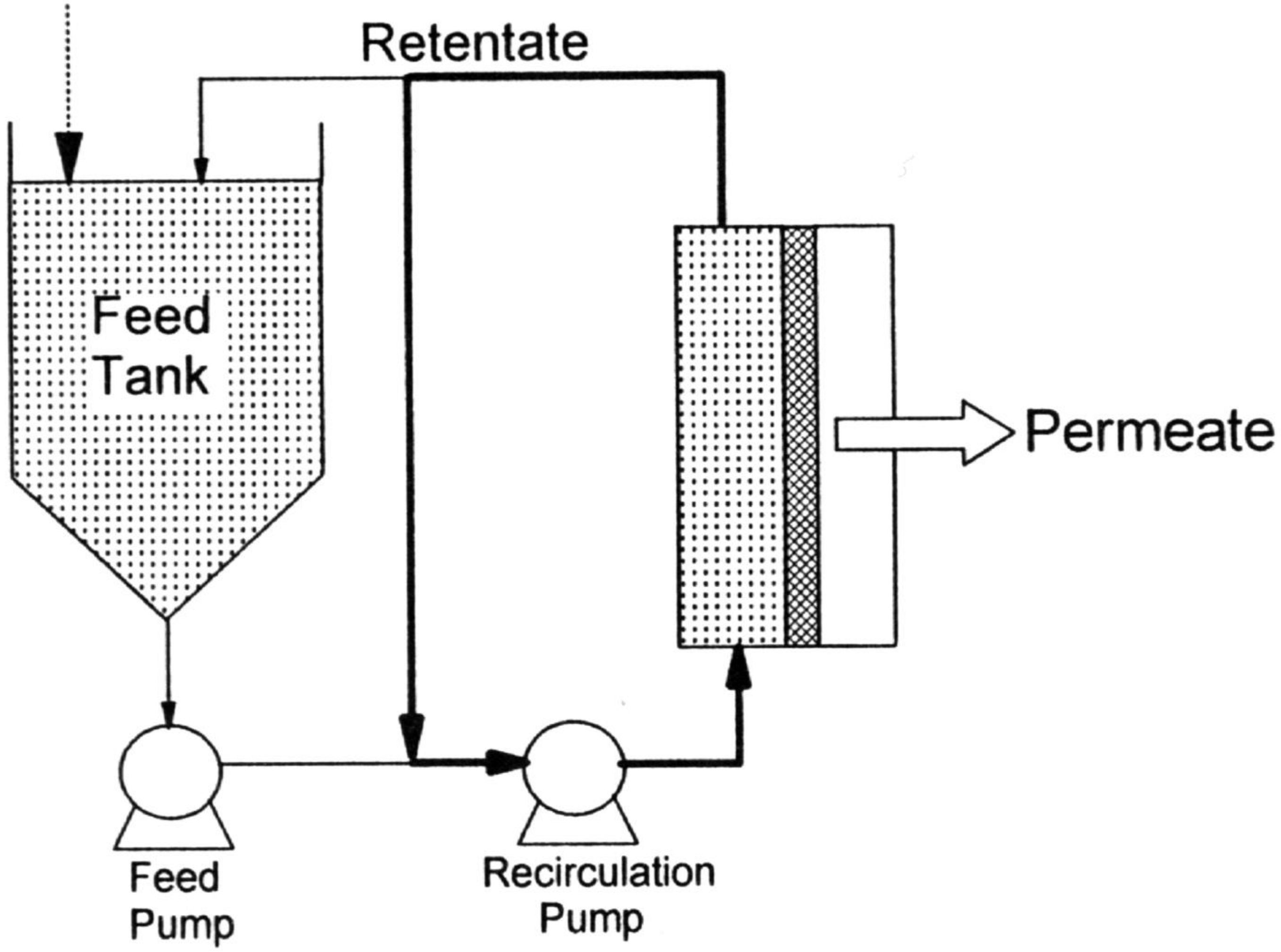
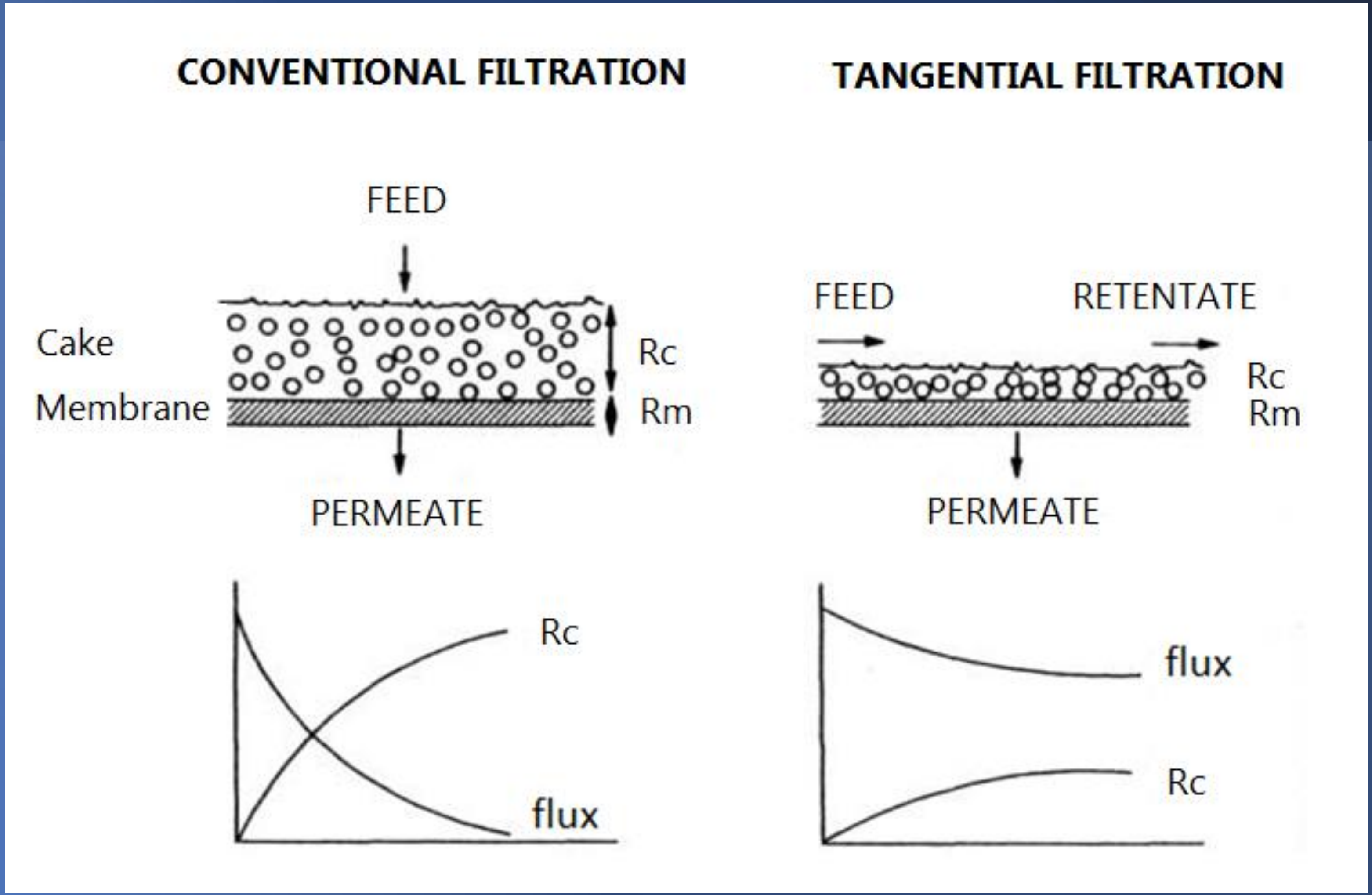
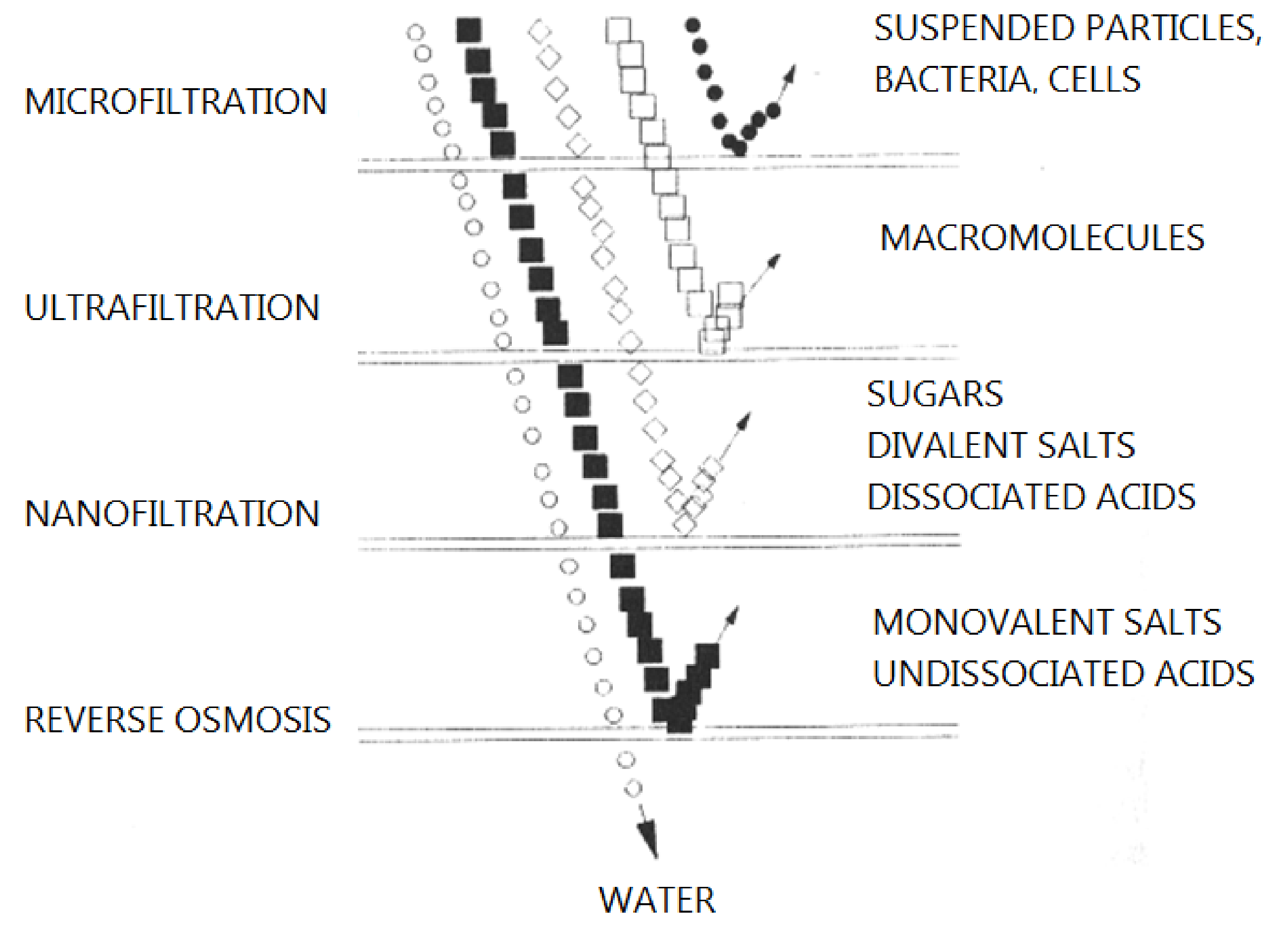
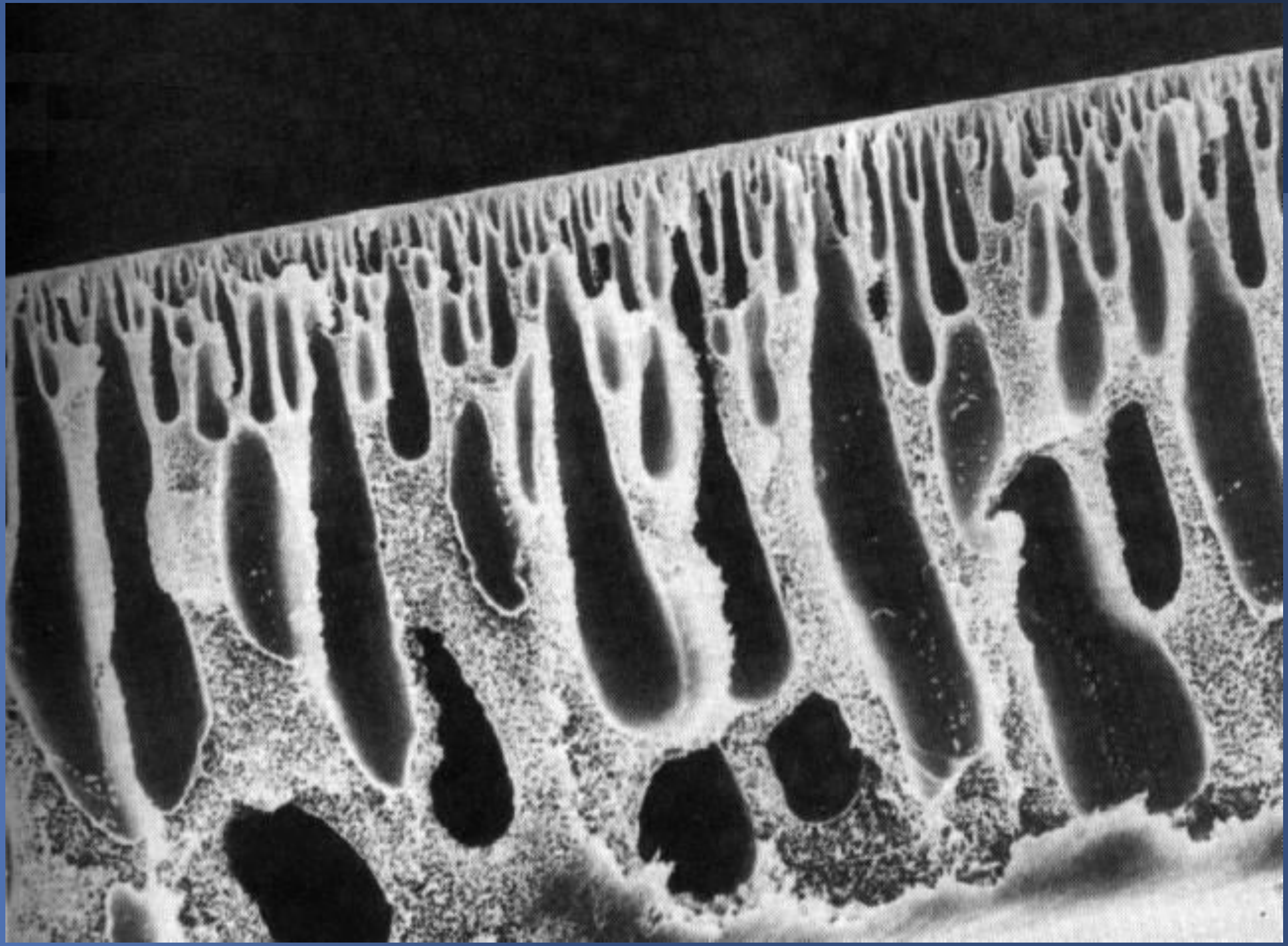
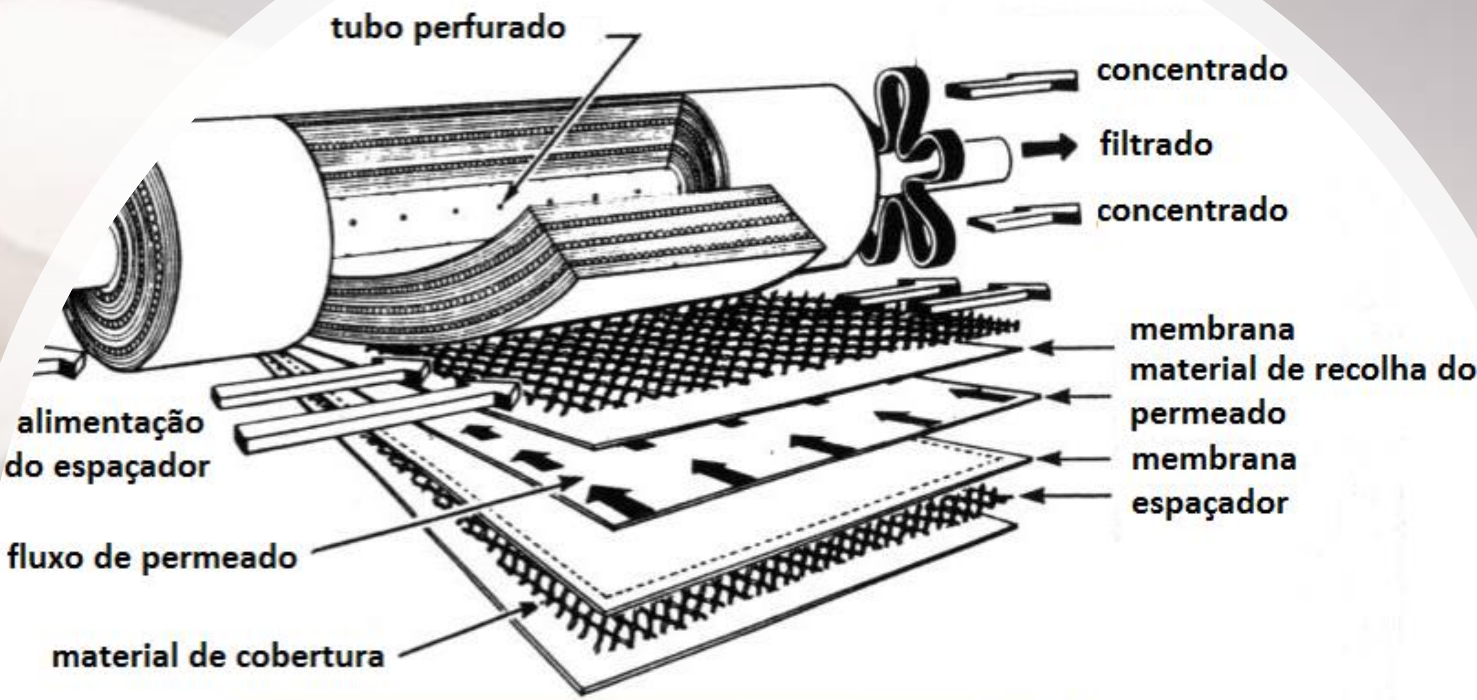

Retentate
Feed
Tank
Permeate
Feed
Pump
Recirculation
Pump

Figure 7.10. *Batch ultrafiltration with partial recycle of retentate. If feed is added continuously at the same rate as the flux, this is the "batch with topped off" mode.*

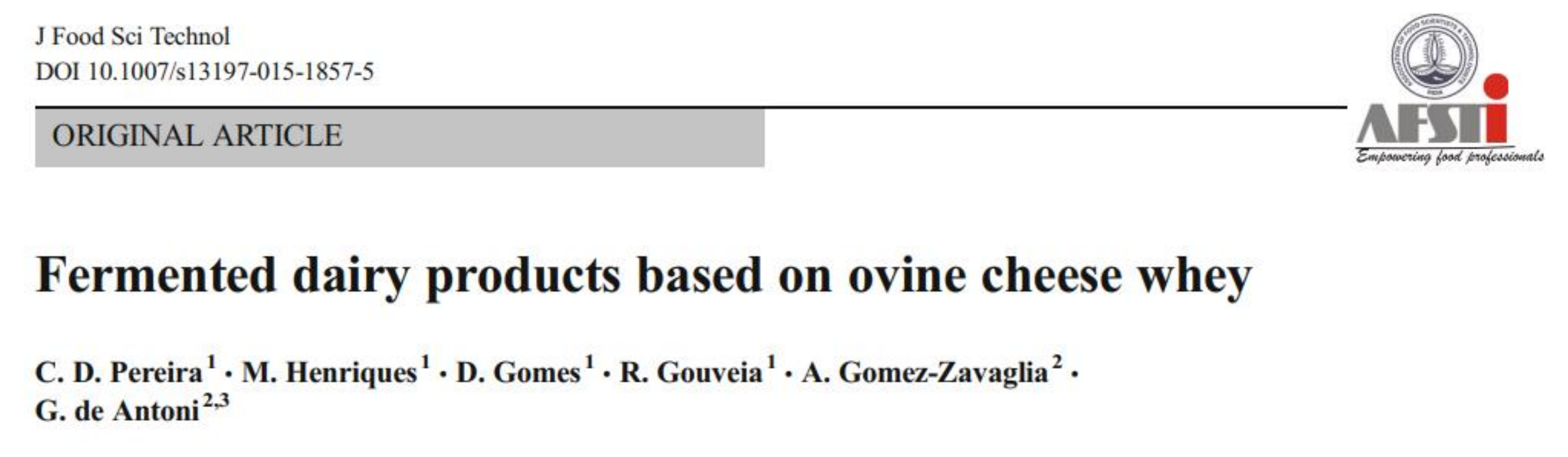

CONVENTIONAL FILTRATION
TANGENTIAL FILTRATION
FEED
Cake
Membrane
Rc
Rm
PERMEATE
Rc
flux
FEED
RETENTATE
Rc
Rm
PERMEATE
flux
Rc


MICROFILTRATION
ULTRAFILTRATION
NANOFILTRATION
REVERSE OSMOSIS
SUSPENDED PARTICLES, BACTERIA, CELLS
MACROMOLECULES
SUGARS
DIVALENT SALTS
DISSOCIATED ACIDS
MONOVALENT SALTS
UNDISSOCIATED ACIDS
WATER




tubo perfurado
concentrado
filtrado
concentrado
membrana
material de recolha do
permeado
membrana
espaçador
alimentação
do espaçador
fluxo de permeado
material de cobertura

INOXPA



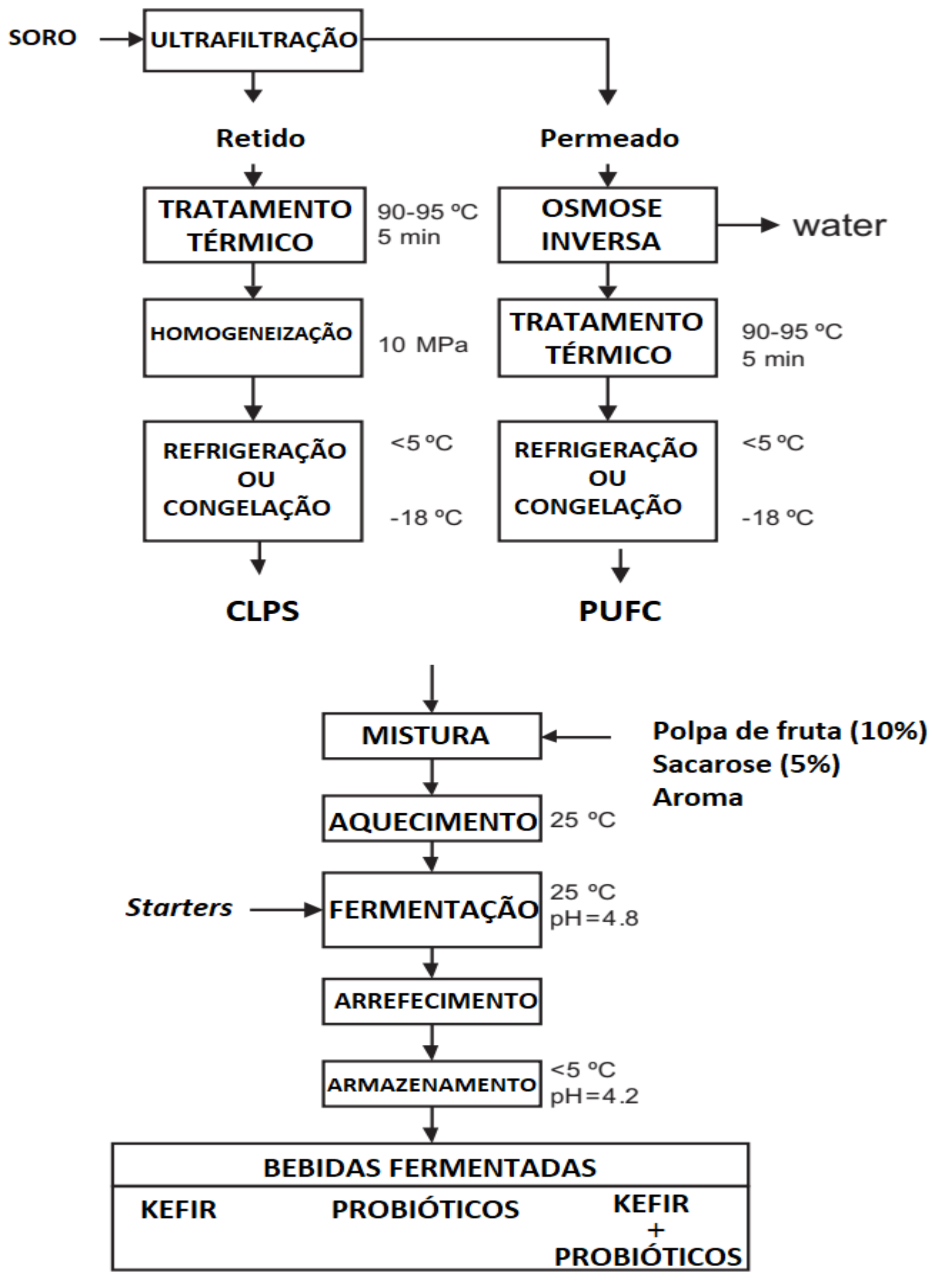
J Food Sci Technol
DOI 10.1007/s13197-015-1857-5

ORIGINAL ARTICLE

Empowering food professionals

Fermented dairy products based on ovine cheese whey

C. D. Pereira[1] · M. Henriques[1] · D. Gomes[1] · R. Gouveia[1] · A. Gomez-Zavaglia[2] ·
G. de Antoni[2,3]



SORO → ULTRAFILTRAÇÃO

Retido

TRATAMENTO TÉRMICO 90-95 ºC 5 min

HOMOGENEIZAÇÃO 10 MPa

REFRIGERAÇÃO OU CONGELAÇÃO <5 ºC -18 ºC

CLPS

Permeado

OSMOSE INVERSA → water

TRATAMENTO TÉRMICO 90-95 ºC 5 min

REFRIGERAÇÃO OU CONGELAÇÃO <5 ºC -18 ºC

PUFC

MISTURA ← Polpa de fruta (10%) Sacarose (5%) Aroma

AQUECIMENTO 25 ºC

Starters → FERMENTAÇÃO 25 ºC pH=4.8

ARREFECIMENTO

ARMAZENAMENTO <5 ºC pH=4.2

BEBIDAS FERMENTADAS		
KEFIR	PROBIÓTICOS	KEFIR + PROBIÓTICOS

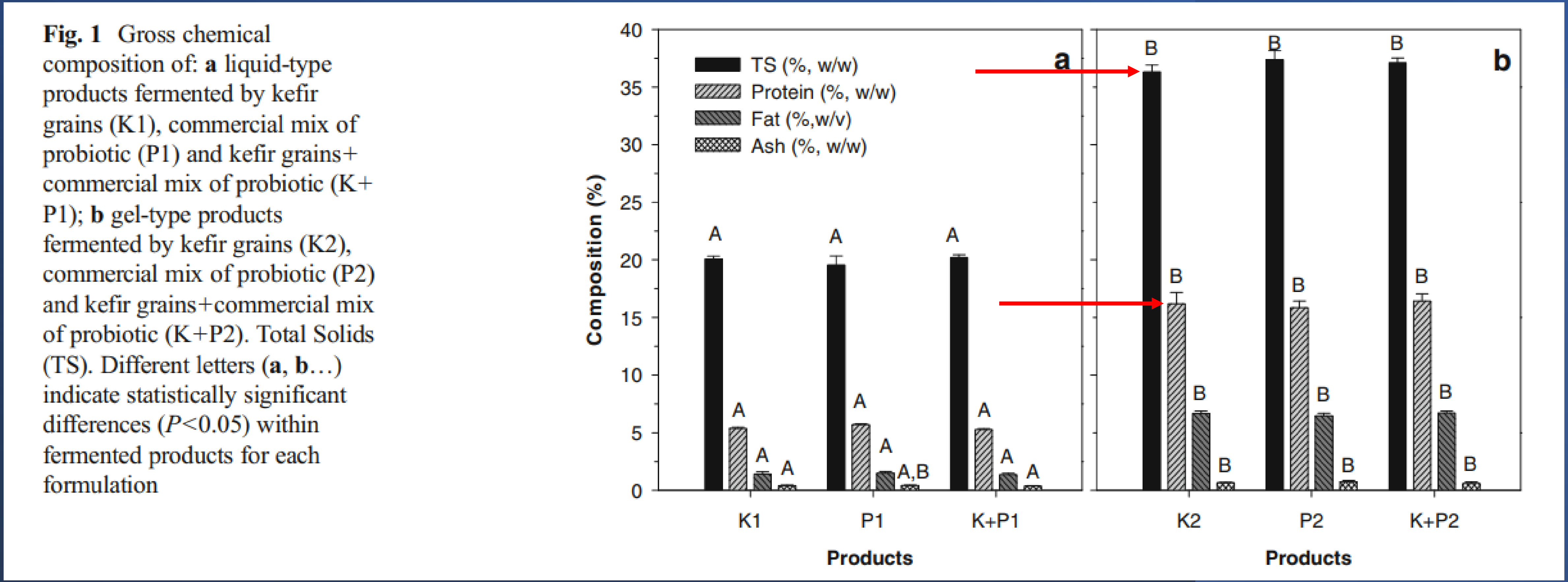
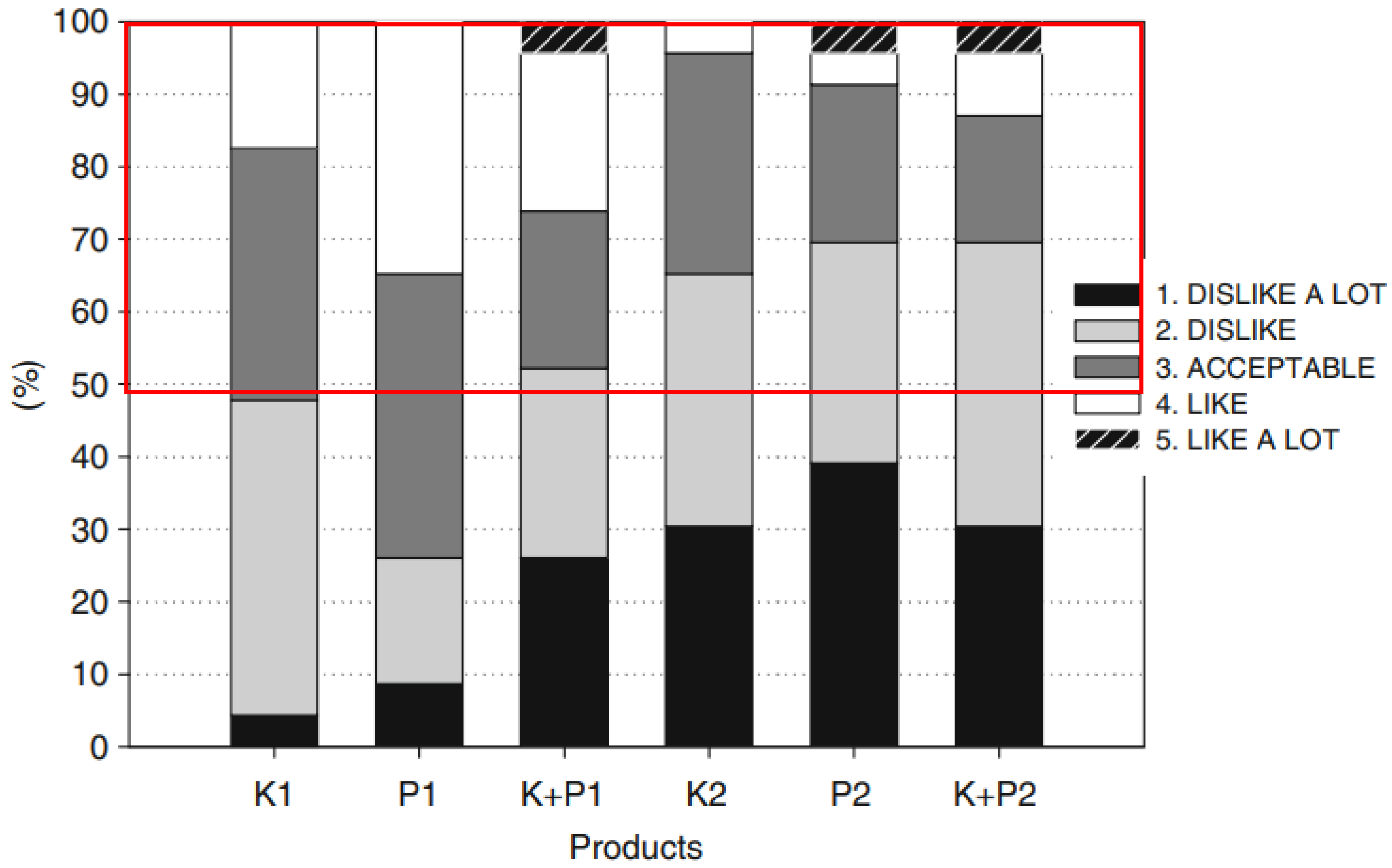
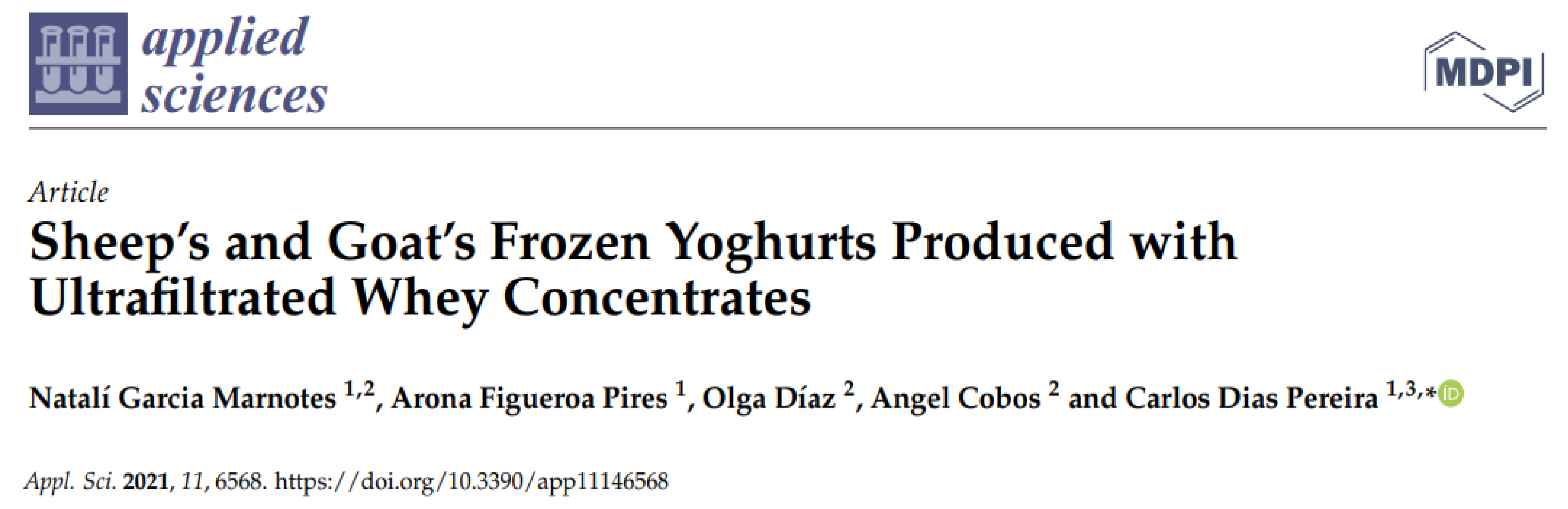


Fig. 1 Gross chemical composition of: **a** liquid-type products fermented by kefir grains (K1), commercial mix of probiotic (P1) and kefir grains+commercial mix of probiotic (K+P1); **b** gel-type products fermented by kefir grains (K2), commercial mix of probiotic (P2) and kefir grains+commercial mix of probiotic (K+P2). Total Solids (TS). Different letters (**a**, **b**…) indicate statistically significant differences (*P*<0.05) within fermented products for each formulation

a
b
TS (%, w/w)
Protein (%, w/w)
Fat (%,w/v)
Ash (%, w/w)
Composition (%)
0
5
10
15
20
25
30
35
40
A
A
A
A
A
A
A
A,B
A
A
A
A
B
B
B
B
B
B
B
B
B
B
B
B
K1
P1
K+P1
K2
P2
K+P2
Products
Products

Fig. 8 Sensorial evaluation of liquid-type fermented products (K1, P1 and K+P1) and gel-type fermented products (K2, P2 and K+P2)





applied
sciences

MDPI

Article

Sheep's and Goat's Frozen Yoghurts Produced with Ultrafiltrated Whey Concentrates

Natalí Garcia Marnotes [1,2], Arona Figueroa Pires [1], Olga Díaz [2], Angel Cobos [2] and Carlos Dias Pereira [1,3,*]

Appl. Sci. **2021**, *11*, 6568. https://doi.org/10.3390/app11146568

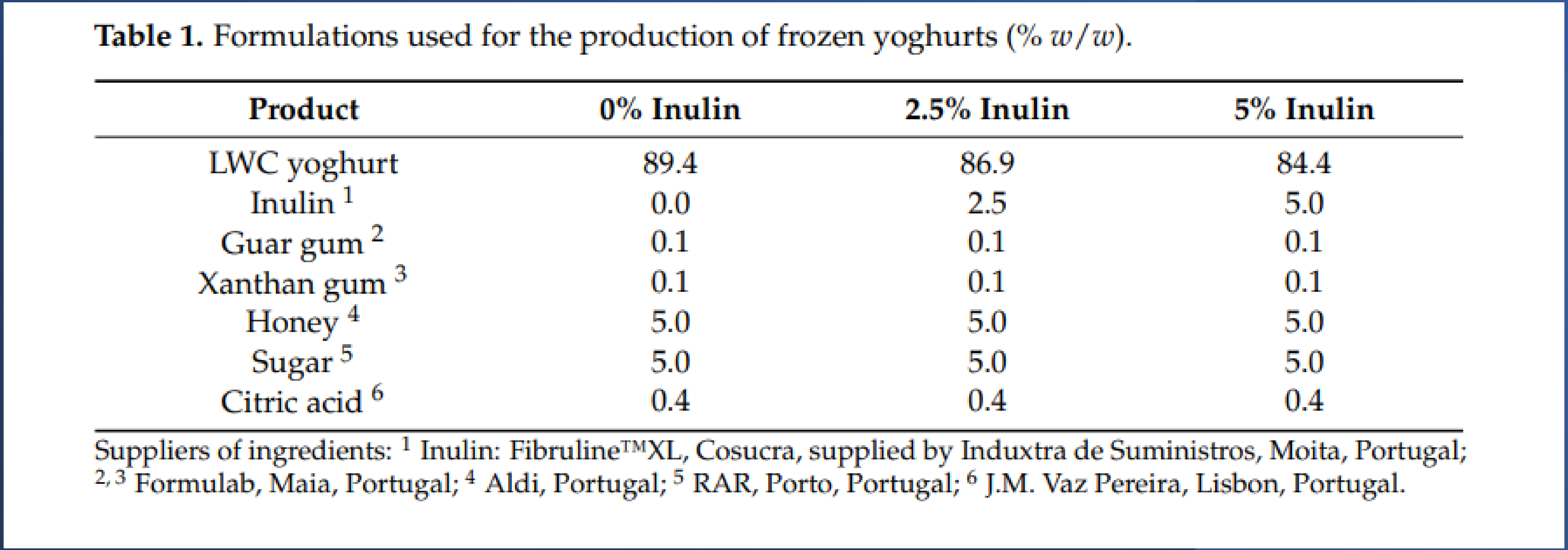


Table 1. Formulations used for the production of frozen yoghurts (% *w*/*w*).

Product	0% Inulin	2.5% Inulin	5% Inulin
LWC yoghurt	89.4	86.9	84.4
Inulin [1]	0.0	2.5	5.0
Guar gum [2]	0.1	0.1	0.1
Xanthan gum [3]	0.1	0.1	0.1
Honey [4]	5.0	5.0	5.0
Sugar [5]	5.0	5.0	5.0
Citric acid [6]	0.4	0.4	0.4

Suppliers of ingredients: [1] Inulin: Fibruline™XL, Cosucra, supplied by Induxtra de Suministros, Moita, Portugal; [2,3] Formulab, Maia, Portugal; [4] Aldi, Portugal; [5] RAR, Porto, Portugal; [6] J.M. Vaz Pereira, Lisbon, Portugal.

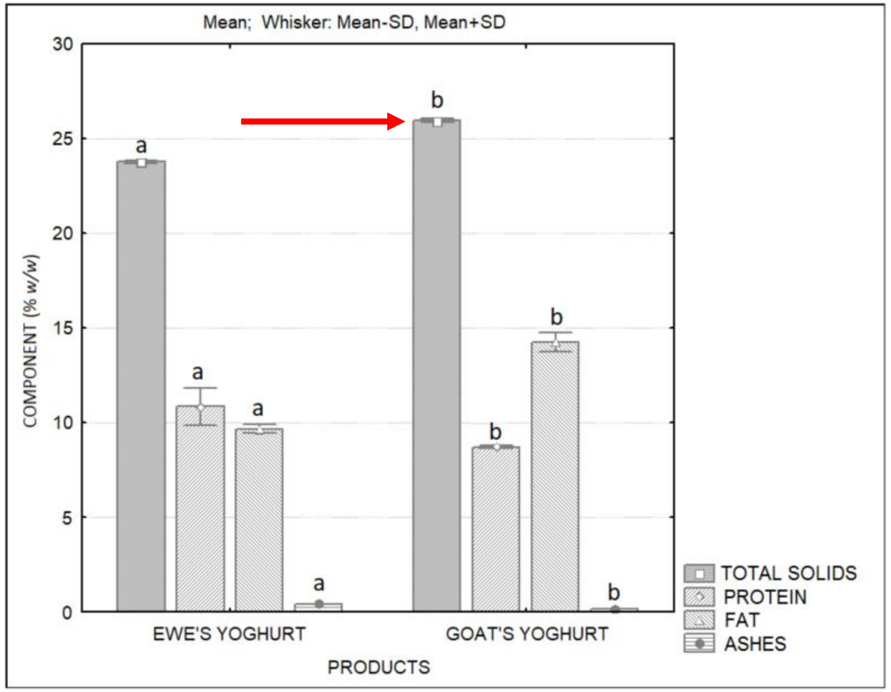


Figure 1. Gross composition of ewe's and goat's yoghurts produced with UF concentrated cheese whey. Different letters indicate significant differences ($p < 0.05$) between components of ewe's and goat's yoghurts.

Table 2. Texture parameters of ewe's and goat's yoghurts one day after production (mean values and standard deviation).

Parameter	Ewe's Yoghurt		Goat's Yoghurt	
	Mean	**±**	**Mean**	**±**
Hardness (N)	13.55 ^{a}	0.33	0.50 ^{b}	0.08
Adhesiveness (N.s)	0.53 ^{a}	0.03	−0.51 ^{b}	0.10
Gumminess (N)	13.52 ^{a}	0.34	0.47 ^{b}	0.08
Cohesiveness	1.00 ^{a}	0.01	0.93 ^{b}	0.02
Resilience	0.90 ^{a}	0.02	0.04 ^{b}	0.01
Viscosity (Cps)	16 946.67 ^{a}	46.19	143.33 ^{b}	12.66

Different superscript letters indicate significant ($p < 0.05$) differences between values in rows.

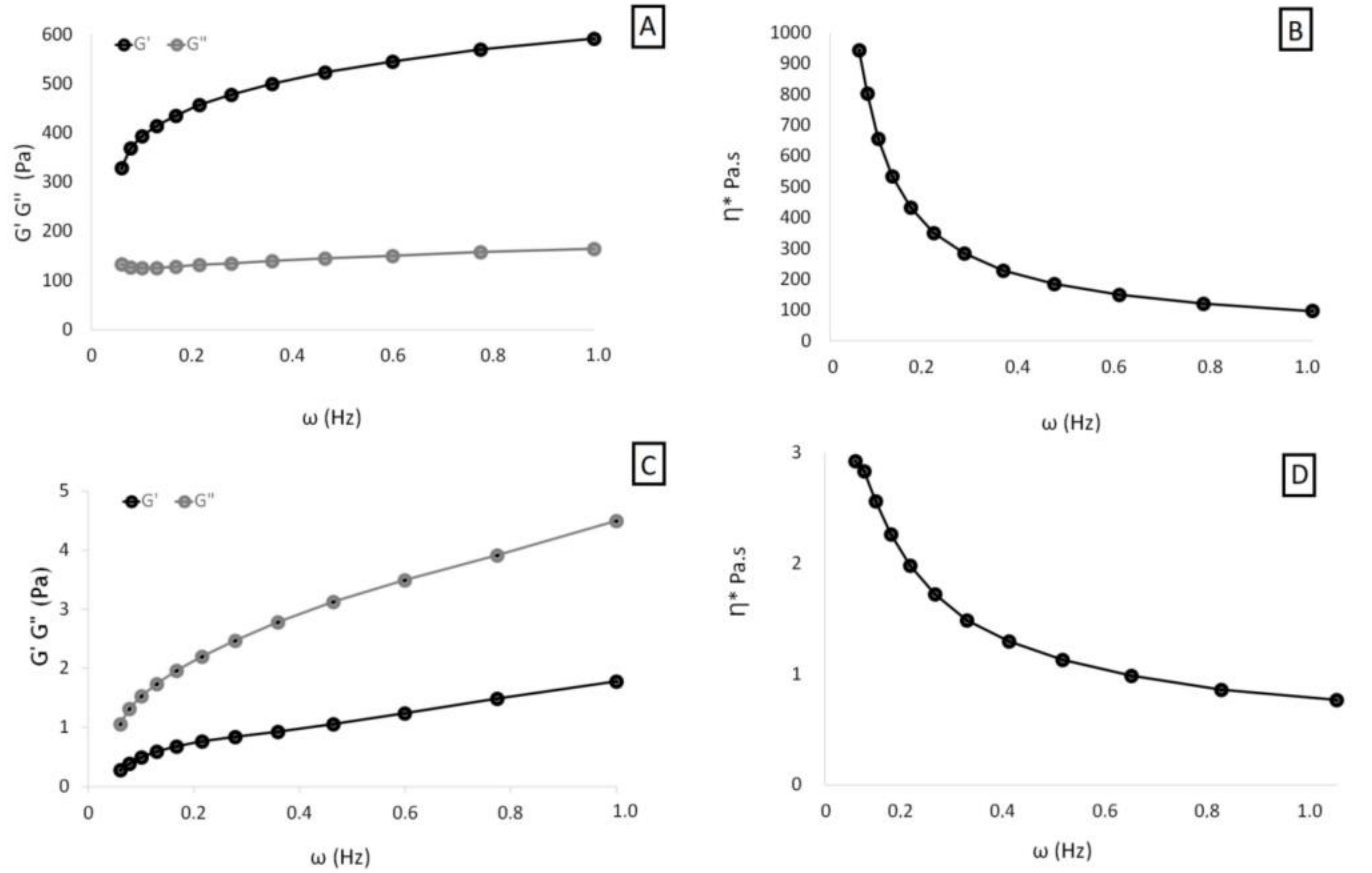


Figure 2. Elastic (G′) and viscous (G′′) moduli and complex viscosity of ewe's (**A**,**B**) and goat's (**C**,**D**) yoghurts produced with UF concentrated cheese whey.

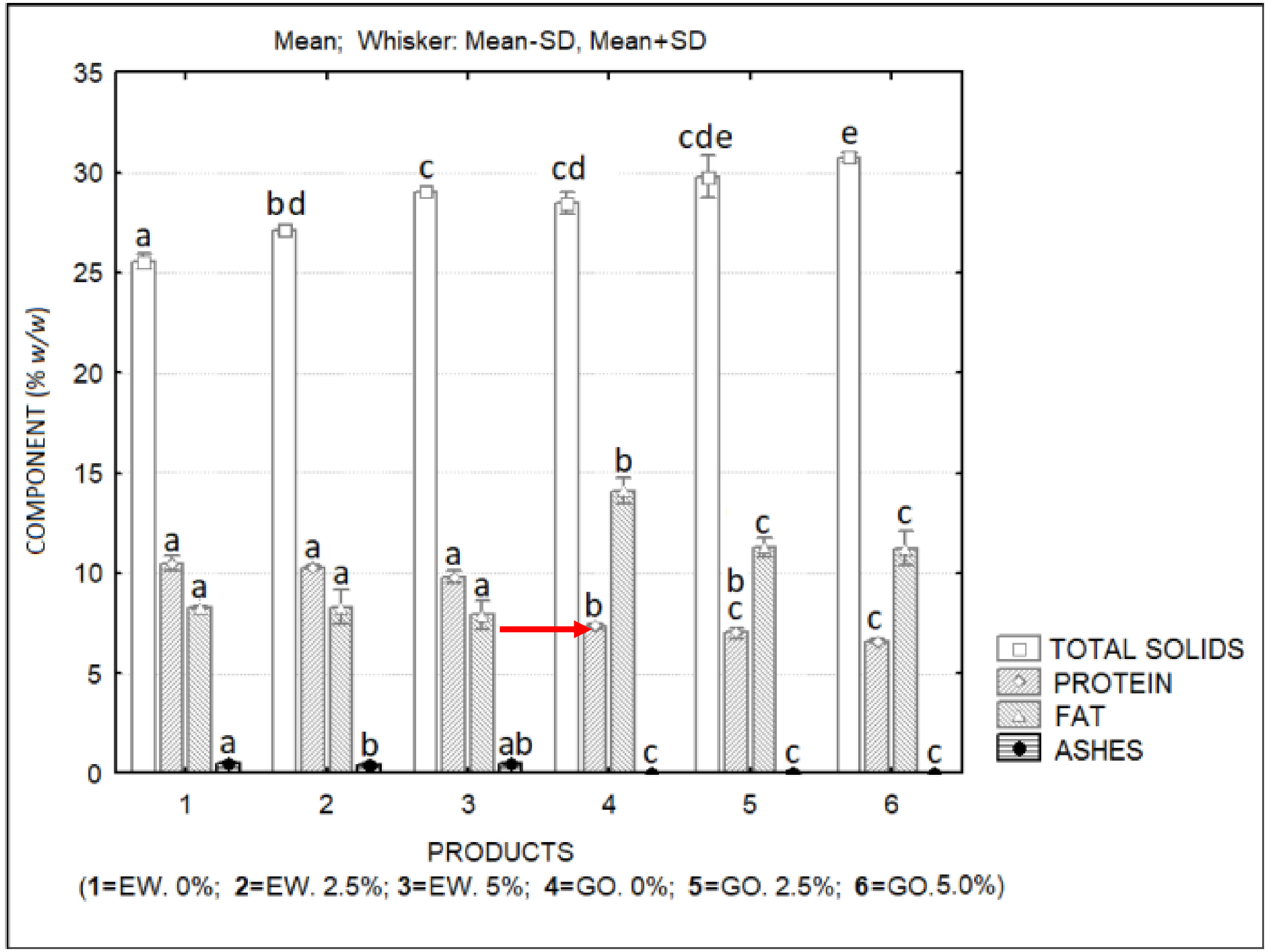


Figure 4. Gross chemical composition of ewe's and goat's frozen yoghurts produced with UF concentrated cheese whey over 21 days of refrigerated storage (EW. 0% = ewe's yoghurt with 0% inulin addition; EW. 2.5% = ewe's yoghurt with 2.5% inulin addition; EW. 5.0% = ewe's yoghurt with 0% inulin addition; GO. 0% = goat's yoghurt with 0% inulin addition; GO. 2.5% = goat's yoghurt with 2.5% inulin addition; GO. 5% = goat's yoghurt with 5% inulin addition). Different letters indicate significant differences ($p < 0.05$) between components of ewe's and goat's frozen yoghurt formulations.

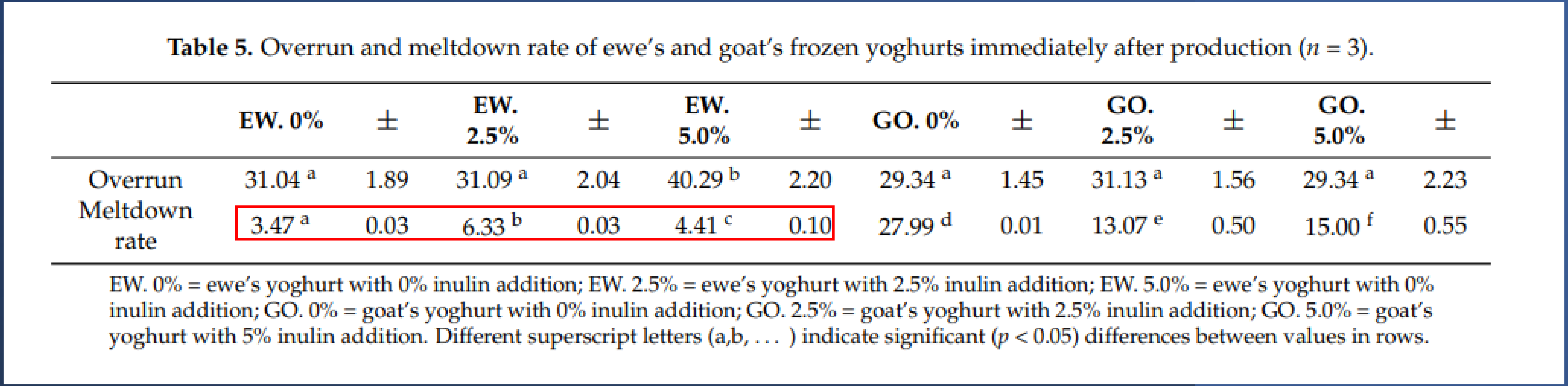


Table 5. Overrun and meltdown rate of ewe's and goat's frozen yoghurts immediately after production ($n = 3$).

	EW. 0%	±	EW. 2.5%	±	EW. 5.0%	±	GO. 0%	±	GO. 2.5%	±	GO. 5.0%	±
Overrun	31.04 ^{a}	1.89	31.09 ^{a}	2.04	40.29 ^{b}	2.20	29.34 ^{a}	1.45	31.13 ^{a}	1.56	29.34 ^{a}	2.23
Meltdown rate	3.47 ^{a}	0.03	6.33 ^{b}	0.03	4.41 ^{c}	0.10	27.99 ^{d}	0.01	13.07 ^{e}	0.50	15.00 ^{f}	0.55

EW. 0% = ewe's yoghurt with 0% inulin addition; EW. 2.5% = ewe's yoghurt with 2.5% inulin addition; EW. 5.0% = ewe's yoghurt with 0% inulin addition; GO. 0% = goat's yoghurt with 0% inulin addition; GO. 2.5% = goat's yoghurt with 2.5% inulin addition; GO. 5.0% = goat's yoghurt with 5% inulin addition. Different superscript letters (a,b, . . .) indicate significant ($p < 0.05$) differences between values in rows.

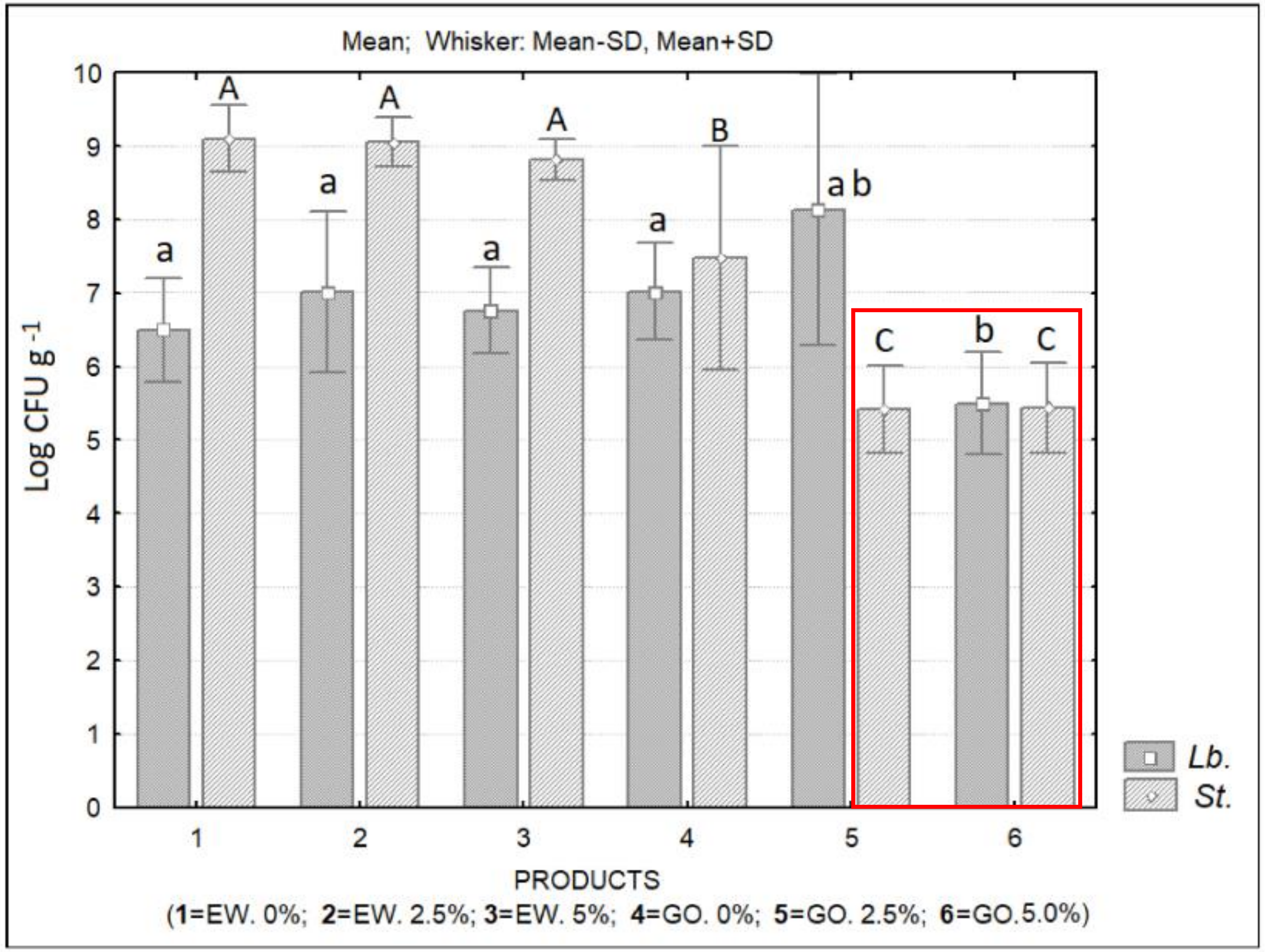


Figure 7. *Lactobacilli* sp. (*Lb.*) and *Streptococci* sp. (*St.*) counts (log CFU g^{-1}) of ewe's and goat's frozen yoghurts produced with UF concentrated cheese whey at the day of production (EW. 0% = ewe's yoghurt with 0% inulin addition; EW. 2.5% = ewe's yoghurt with 2.5% inulin addition; EW. 5.0% = ewe's yoghurt with 0% inulin addition; GO. 0% = goat's yoghurt with 0% inulin addition; GO. 2.5% = goat's yoghurt with 2.5% inulin addition; GO. 5% = goat's yoghurt with 5% inulin addition). Different superscript letters indicate significant differences ($p < 0.05$) between products for lactobacilli (a, b, c) and streptococci (A, B, C) counts.

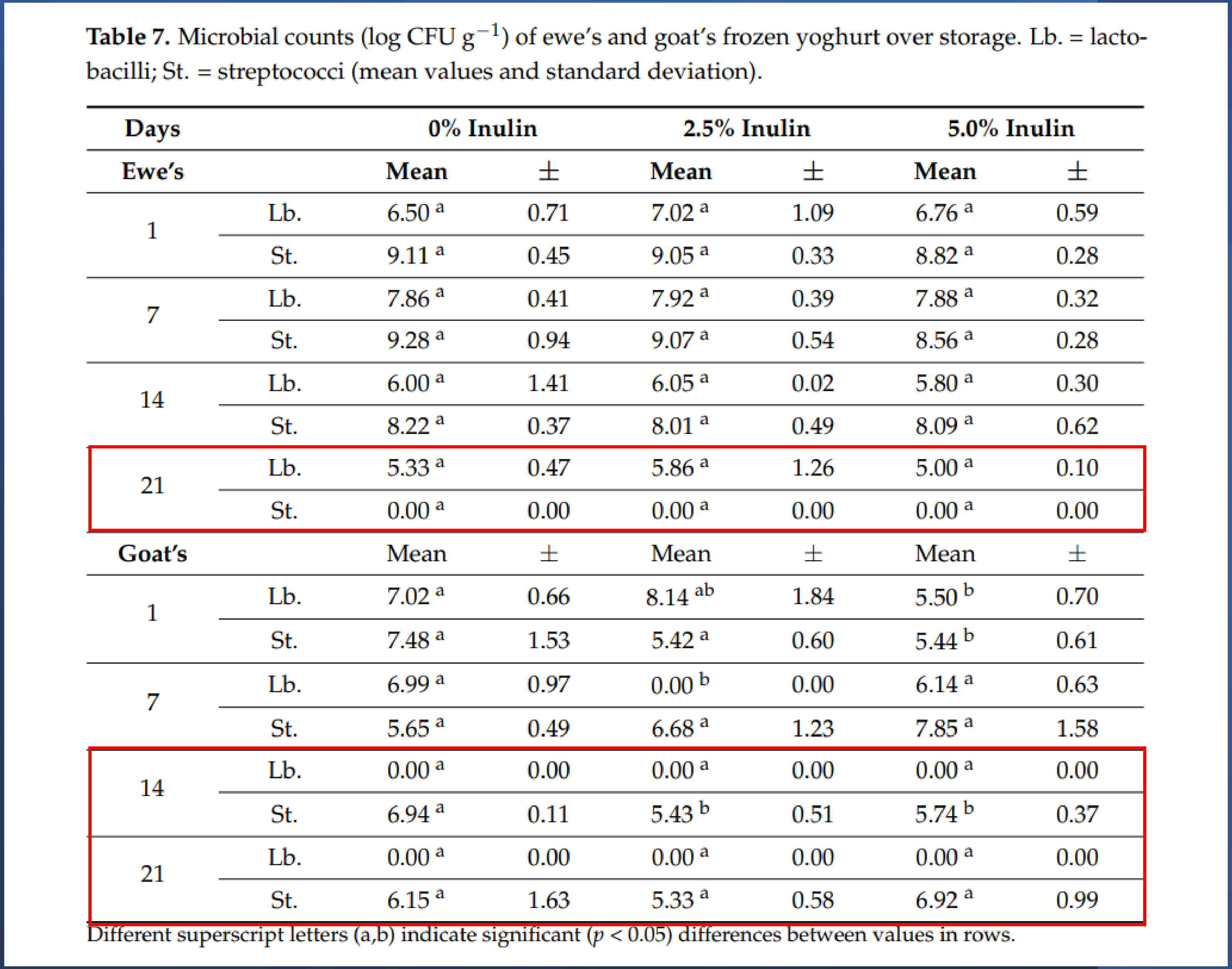


Table 7. Microbial counts (log CFU g^{-1}) of ewe's and goat's frozen yoghurt over storage. Lb. = lactobacilli; St. = streptococci (mean values and standard deviation).

Days		**0% Inulin**		**2.5% Inulin**		**5.0% Inulin**	
Ewe's		**Mean**	**±**	**Mean**	**±**	**Mean**	**±**
1	Lb.	6.50 ^{a}	0.71	7.02 ^{a}	1.09	6.76 ^{a}	0.59
	St.	9.11 ^{a}	0.45	9.05 ^{a}	0.33	8.82 ^{a}	0.28
7	Lb.	7.86 ^{a}	0.41	7.92 ^{a}	0.39	7.88 ^{a}	0.32
	St.	9.28 ^{a}	0.94	9.07 ^{a}	0.54	8.56 ^{a}	0.28
14	Lb.	6.00 ^{a}	1.41	6.05 ^{a}	0.02	5.80 ^{a}	0.30
	St.	8.22 ^{a}	0.37	8.01 ^{a}	0.49	8.09 ^{a}	0.62
21	Lb.	5.33 ^{a}	0.47	5.86 ^{a}	1.26	5.00 ^{a}	0.10
	St.	0.00 ^{a}	0.00	0.00 ^{a}	0.00	0.00 ^{a}	0.00
Goat's		Mean	±	Mean	±	Mean	±
1	Lb.	7.02 ^{a}	0.66	8.14 ^{ab}	1.84	5.50 ^{b}	0.70
	St.	7.48 ^{a}	1.53	5.42 ^{a}	0.60	5.44 ^{b}	0.61
7	Lb.	6.99 ^{a}	0.97	0.00 ^{b}	0.00	6.14 ^{a}	0.63
	St.	5.65 ^{a}	0.49	6.68 ^{a}	1.23	7.85 ^{a}	1.58
14	Lb.	0.00 ^{a}	0.00	0.00 ^{a}	0.00	0.00 ^{a}	0.00
	St.	6.94 ^{a}	0.11	5.43 ^{b}	0.51	5.74 ^{b}	0.37
21	Lb.	0.00 ^{a}	0.00	0.00 ^{a}	0.00	0.00 ^{a}	0.00
	St.	6.15 ^{a}	1.63	5.33 ^{a}	0.58	6.92 ^{a}	0.99

Different superscript letters (a,b) indicate significant ($p < 0.05$) differences between values in rows.

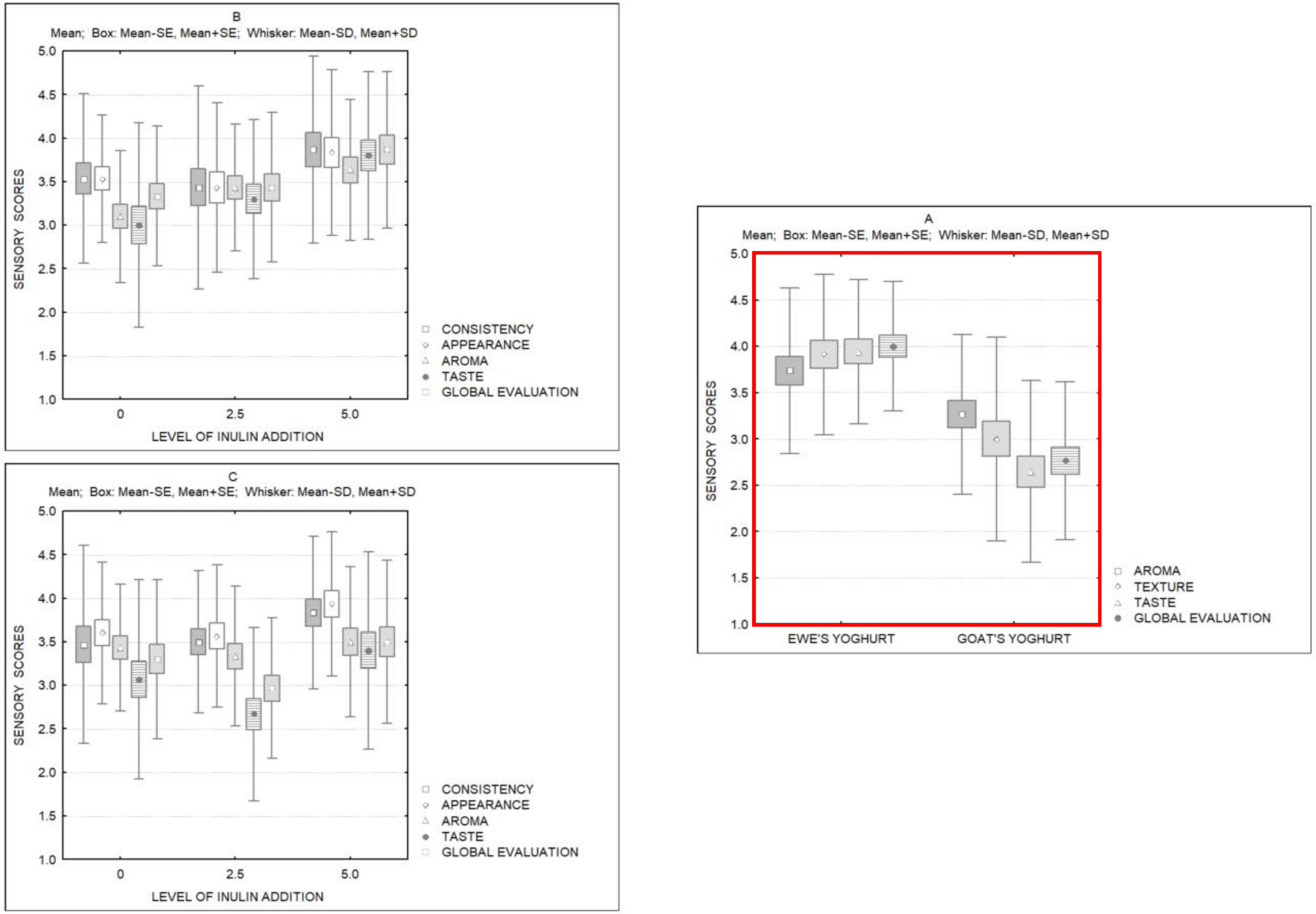


Figure 8. Sensory scores of ewe's and goat's yoghurts and correspondent frozen yoghurts produced with UF concentrated cheese whey ((**A**) = ewe's and goat's yoghurts; (**B**) = ewe's frozen yoghurts, (**C**) = goat's frozen yoghurts).

foods

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Article

Evaluation of the Characteristics of Sheep's and Goat's Ice Cream, Produced with UF Concentrated Second Cheese Whey and Different Starter Cultures

Arona Pires [1,2], David Gomes [1], João Noronha [1], Olga Díaz [2], Angel Cobos [2] and Carlos Dias Pereira [1,3,*]

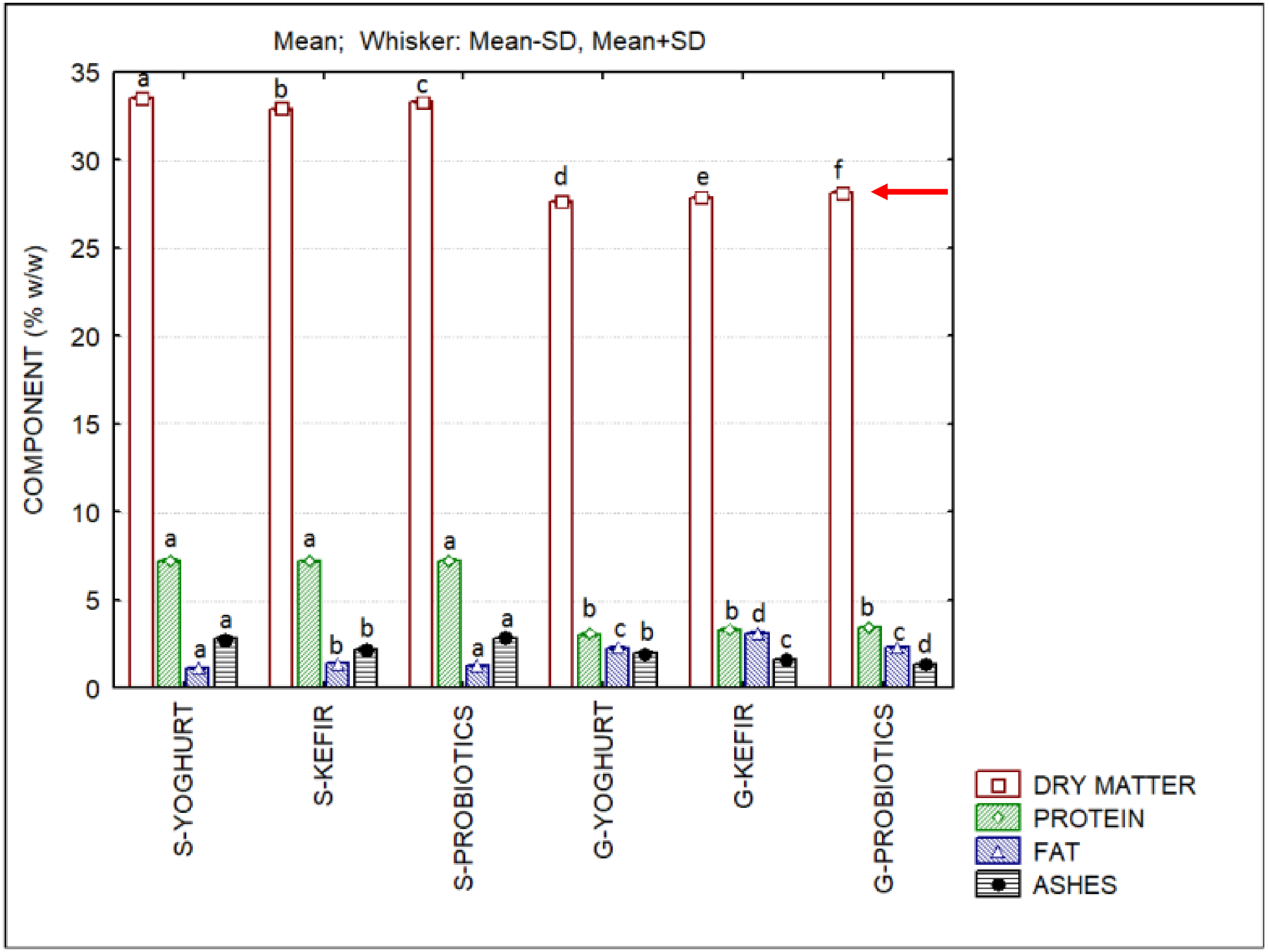


Figure 1. Chemical composition of sheep's and goat's second cheese whey ice creams produced with different starter cultures. Different letters of the same component indicate significant differences ($p < 0.05$) among ice creams.

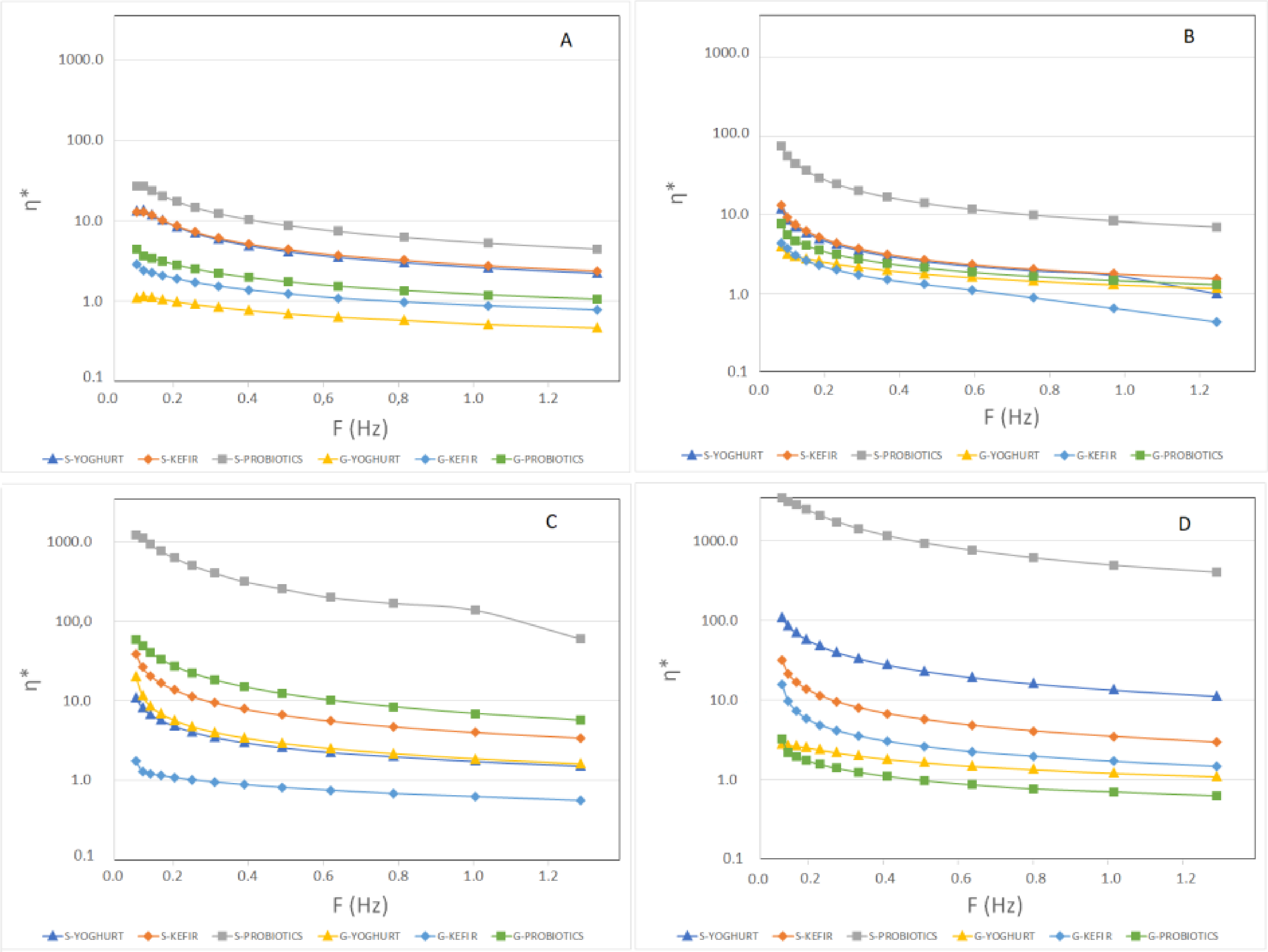


Figure 4. Complex viscosity (η*) of sheep's and goat's second cheese whey ice creams produced with different starter cultures over storage. 1 day (**A**); 30 days (**B**); 60 days (**C**); 120 days (**D**).

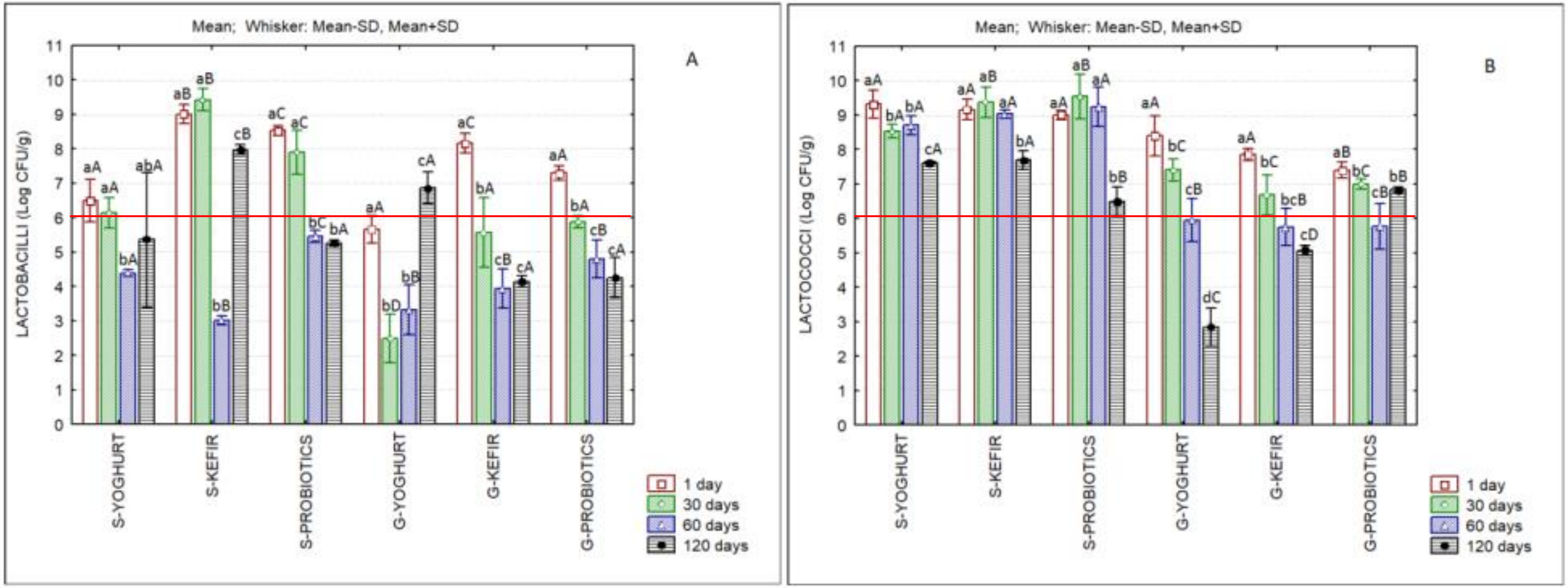


Figure 6. Evaluation of microbial counts of sheep's and goat's second cheese whey ice creams produced with different starter cultures over storage. *Lactobacilli* sp. (**A**); *Lactococci* sp. (**B**). Different lowercase letters in each type of ice cream indicate significant differences ($p < 0.05$) among storage days and different capital letters in each storage day indicate significant differences ($p < 0.05$) among ice creams.

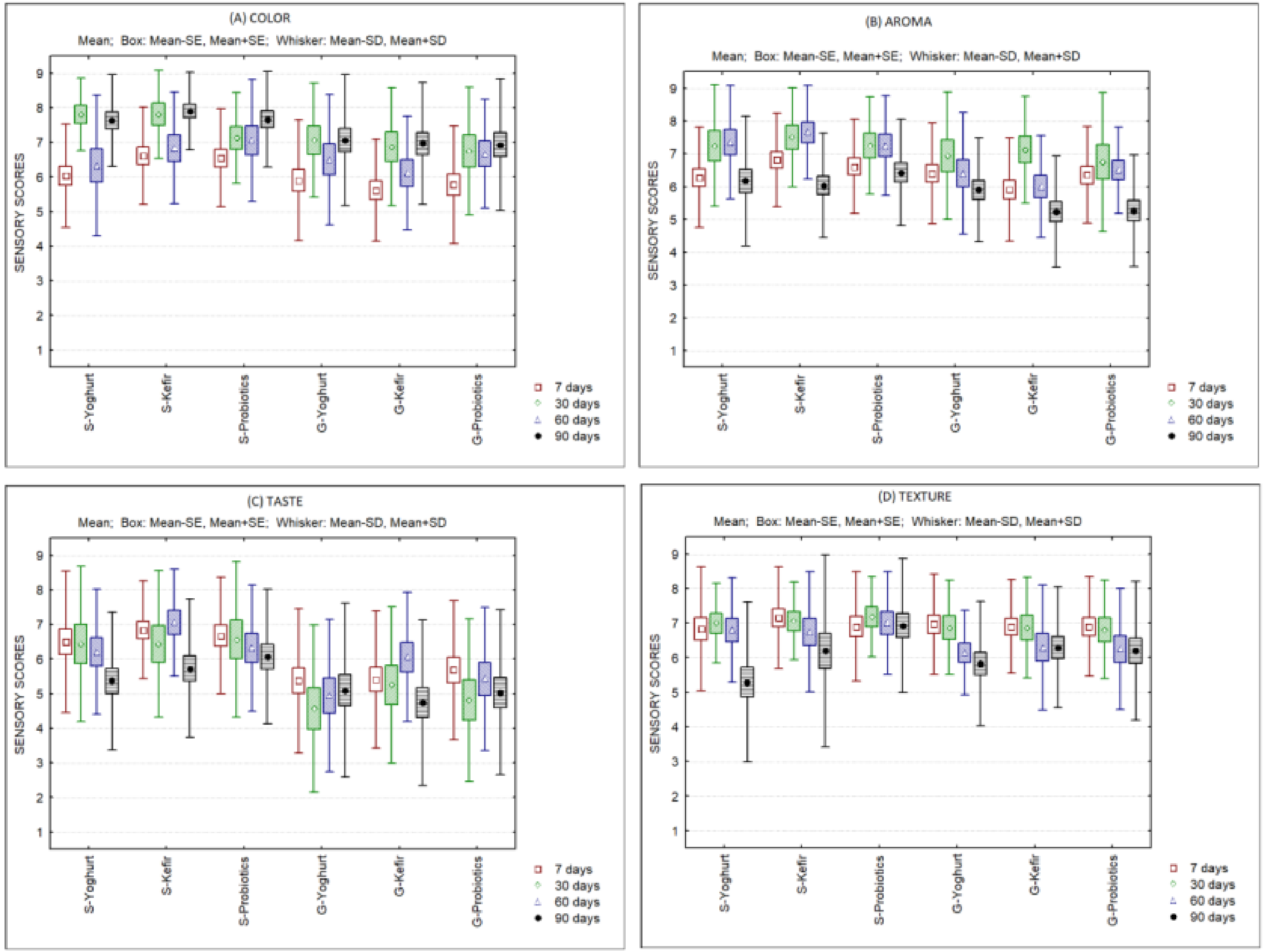
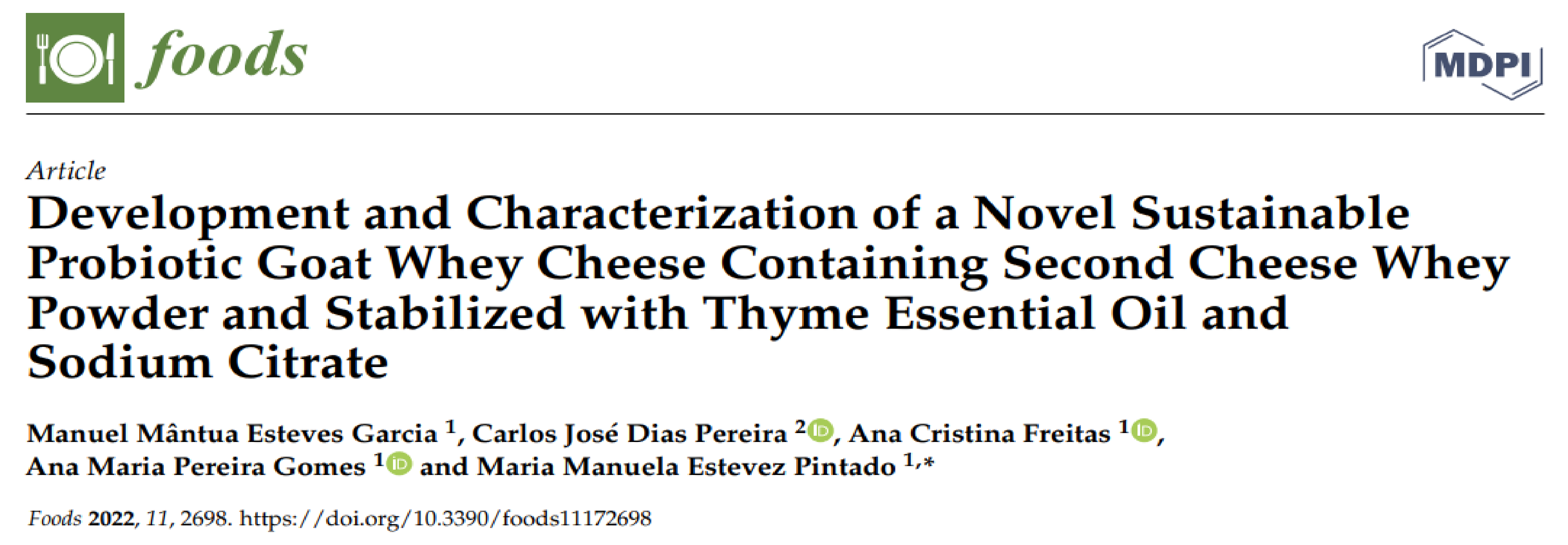


Figure 7. Sensory scores of sheep's and goat's second cheese whey ice creams produced with different starter cultures over 120 days of storage. Color (**A**); Aroma (**B**); Taste (**C**); Texture (**D**).



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Article

Development and Characterization of a Novel Sustainable Probiotic Goat Whey Cheese Containing Second Cheese Whey Powder and Stabilized with Thyme Essential Oil and Sodium Citrate

Manuel Mântua Esteves Garcia [1], Carlos José Dias Pereira [2], Ana Cristina Freitas [1], Ana Maria Pereira Gomes [1] and Maria Manuela Estevez Pintado [1,*]

Foods **2022**, *11*, 2698. https://doi.org/10.3390/foods11172698

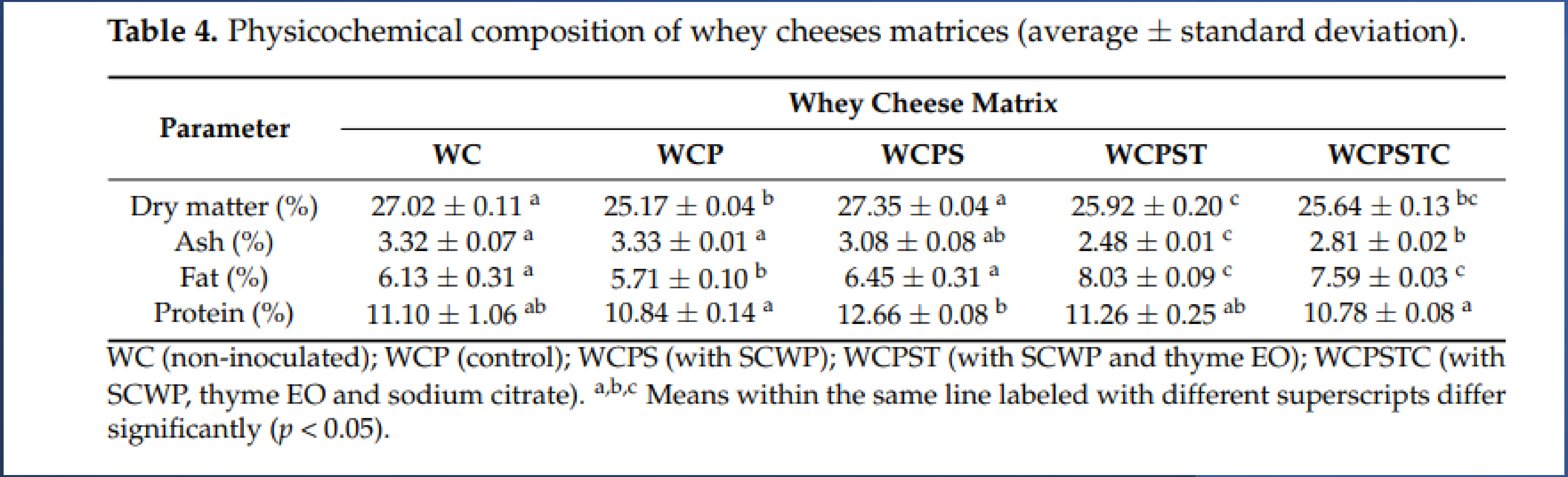


Table 4. Physicochemical composition of whey cheeses matrices (average ± standard deviation).

Parameter	Whey Cheese Matrix				
	WC	WCP	WCPS	WCPST	WCPSTC
Dry matter (%)	27.02 ± 0.11 ^{a}	25.17 ± 0.04 ^{b}	27.35 ± 0.04 ^{a}	25.92 ± 0.20 ^{c}	25.64 ± 0.13 ^{bc}
Ash (%)	3.32 ± 0.07 ^{a}	3.33 ± 0.01 ^{a}	3.08 ± 0.08 ^{ab}	2.48 ± 0.01 ^{c}	2.81 ± 0.02 ^{b}
Fat (%)	6.13 ± 0.31 ^{a}	5.71 ± 0.10 ^{b}	6.45 ± 0.31 ^{a}	8.03 ± 0.09 ^{c}	7.59 ± 0.03 ^{c}
Protein (%)	11.10 ± 1.06 ^{ab}	10.84 ± 0.14 ^{a}	12.66 ± 0.08 ^{b}	11.26 ± 0.25 ^{ab}	10.78 ± 0.08 ^{a}

WC (non-inoculated); WCP (control); WCPS (with SCWP); WCPST (with SCWP and thyme EO); WCPSTC (with SCWP, thyme EO and sodium citrate). ^{a,b,c} Means within the same line labeled with different superscripts differ significantly ($p < 0.05$).

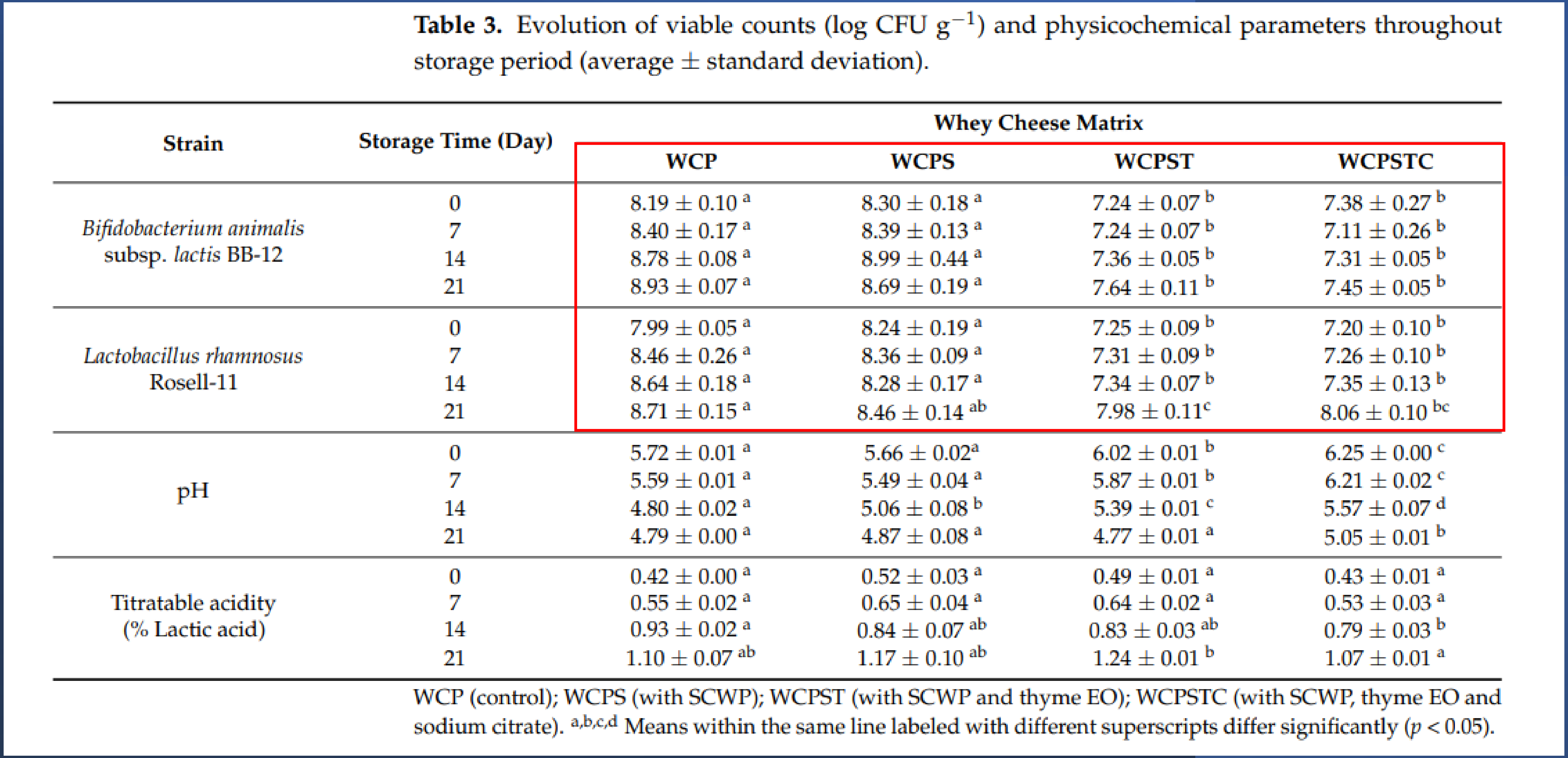


Table 3. Evolution of viable counts (log CFU g^{-1}) and physicochemical parameters throughout storage period (average ± standard deviation).

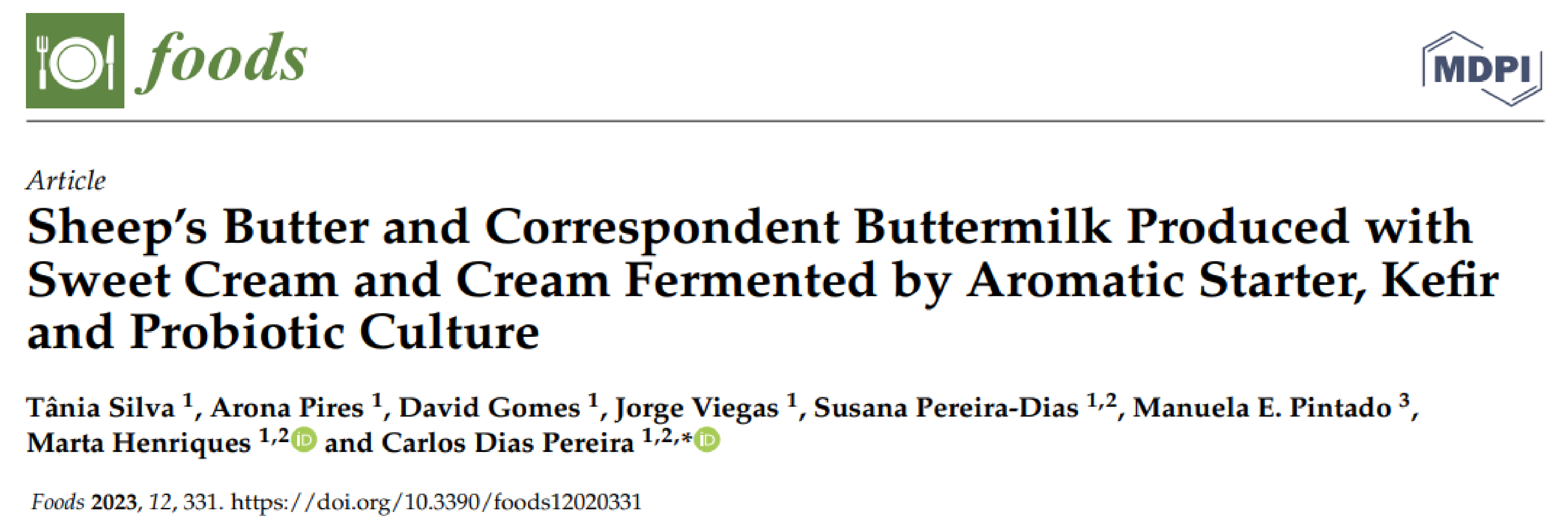
Strain	**Storage Time (Day)**	**Whey Cheese Matrix**			
		WCP	**WCPS**	**WCPST**	**WCPSTC**
Bifidobacterium animalis subsp. *lactis* BB-12	0	8.19 ± 0.10 ^{a}	8.30 ± 0.18 ^{a}	7.24 ± 0.07 ^{b}	7.38 ± 0.27 ^{b}
	7	8.40 ± 0.17 ^{a}	8.39 ± 0.13 ^{a}	7.24 ± 0.07 ^{b}	7.11 ± 0.26 ^{b}
	14	8.78 ± 0.08 ^{a}	8.99 ± 0.44 ^{a}	7.36 ± 0.05 ^{b}	7.31 ± 0.05 ^{b}
	21	8.93 ± 0.07 ^{a}	8.69 ± 0.19 ^{a}	7.64 ± 0.11 ^{b}	7.45 ± 0.05 ^{b}
Lactobacillus rhamnosus Rosell-11	0	7.99 ± 0.05 ^{a}	8.24 ± 0.19 ^{a}	7.25 ± 0.09 ^{b}	7.20 ± 0.10 ^{b}
	7	8.46 ± 0.26 ^{a}	8.36 ± 0.09 ^{a}	7.31 ± 0.09 ^{b}	7.26 ± 0.10 ^{b}
	14	8.64 ± 0.18 ^{a}	8.28 ± 0.17 ^{a}	7.34 ± 0.07 ^{b}	7.35 ± 0.13 ^{b}
	21	8.71 ± 0.15 ^{a}	8.46 ± 0.14 ^{ab}	7.98 ± 0.11^{c}	8.06 ± 0.10 ^{bc}
pH	0	5.72 ± 0.01 ^{a}	5.66 ± 0.02^{a}	6.02 ± 0.01 ^{b}	6.25 ± 0.00 ^{c}
	7	5.59 ± 0.01 ^{a}	5.49 ± 0.04 ^{a}	5.87 ± 0.01 ^{b}	6.21 ± 0.02 ^{c}
	14	4.80 ± 0.02 ^{a}	5.06 ± 0.08 ^{b}	5.39 ± 0.01 ^{c}	5.57 ± 0.07 ^{d}
	21	4.79 ± 0.00 ^{a}	4.87 ± 0.08 ^{a}	4.77 ± 0.01 ^{a}	5.05 ± 0.01 ^{b}
Titratable acidity (% Lactic acid)	0	0.42 ± 0.00 ^{a}	0.52 ± 0.03 ^{a}	0.49 ± 0.01 ^{a}	0.43 ± 0.01 ^{a}
	7	0.55 ± 0.02 ^{a}	0.65 ± 0.04 ^{a}	0.64 ± 0.02 ^{a}	0.53 ± 0.03 ^{a}
	14	0.93 ± 0.02 ^{a}	0.84 ± 0.07 ^{ab}	0.83 ± 0.03 ^{ab}	0.79 ± 0.03 ^{b}
	21	1.10 ± 0.07 ^{ab}	1.17 ± 0.10 ^{ab}	1.24 ± 0.01 ^{b}	1.07 ± 0.01 ^{a}

WCP (control); WCPS (with SCWP); WCPST (with SCWP and thyme EO); WCPSTC (with SCWP, thyme EO and sodium citrate). ^{a,b,c,d} Means within the same line labeled with different superscripts differ significantly ($p < 0.05$).

Manteiga e leitelho de ovelha com adição de microrganismos probióticos

A produção de produtos lácteos fermentados com base em leite de pequenos ruminantes (*e.g.* iogurtes) pode também ser uma oportunidade de diversificação do portfolio de produtos das empresas.

Podem ainda ser obtidos outros produtos, como sejam a manteiga de ovelha/cabra e o leitelho fermentado.



foods

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Article

Sheep's Butter and Correspondent Buttermilk Produced with Sweet Cream and Cream Fermented by Aromatic Starter, Kefir and Probiotic Culture

Tânia Silva [1], Arona Pires [1], David Gomes [1], Jorge Viegas [1], Susana Pereira-Dias [1,2], Manuela E. Pintado [3], Marta Henriques [1,2] and Carlos Dias Pereira [1,2,*]

Foods **2023**, *12*, 331. https://doi.org/10.3390/foods12020331

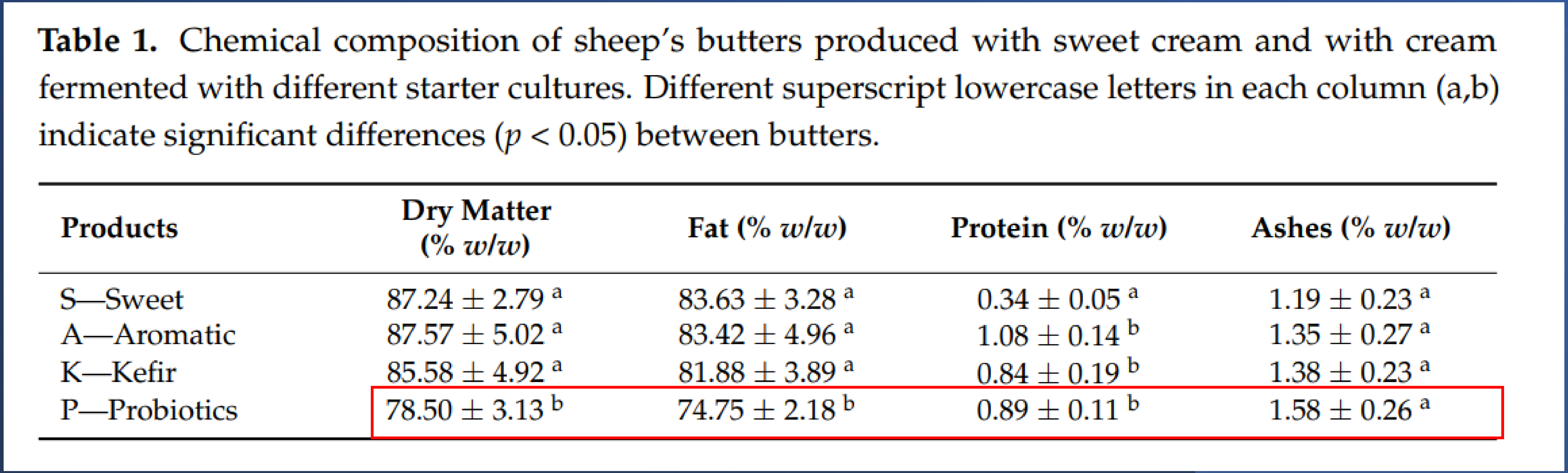


Table 1. Chemical composition of sheep's butters produced with sweet cream and with cream fermented with different starter cultures. Different superscript lowercase letters in each column (a,b) indicate significant differences ($p < 0.05$) between butters.

Products	Dry Matter (% *w*/*w*)	Fat (% *w*/*w*)	Protein (% *w*/*w*)	Ashes (% *w*/*w*)
S—Sweet	87.24 ± 2.79^{a}	83.63 ± 3.28^{a}	0.34 ± 0.05^{a}	1.19 ± 0.23^{a}
A—Aromatic	87.57 ± 5.02^{a}	83.42 ± 4.96^{a}	1.08 ± 0.14^{b}	1.35 ± 0.27^{a}
K—Kefir	85.58 ± 4.92^{a}	81.88 ± 3.89^{a}	0.84 ± 0.19^{b}	1.38 ± 0.23^{a}
P—Probiotics	78.50 ± 3.13^{b}	74.75 ± 2.18^{b}	0.89 ± 0.11^{b}	1.58 ± 0.26^{a}

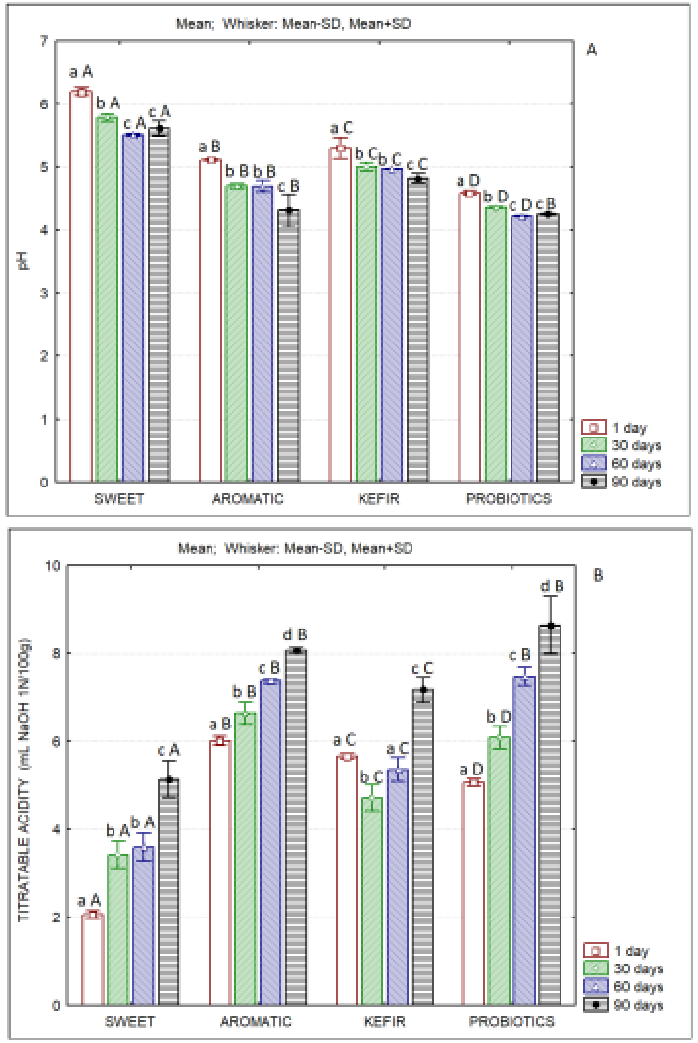


Figure 1. Evolution of pH (**A**) and titratable acidity (**B**) of sheep's butters produced with sweet cream and with cream fermented with different starter cultures. Different lowercase letters (a,b,c,d) indicate significant differences ($p < 0.05$) between days of storage; Different capital letters (A,B,C,D) indicate significant differences ($p < 0.05$) between products at the same storage day.

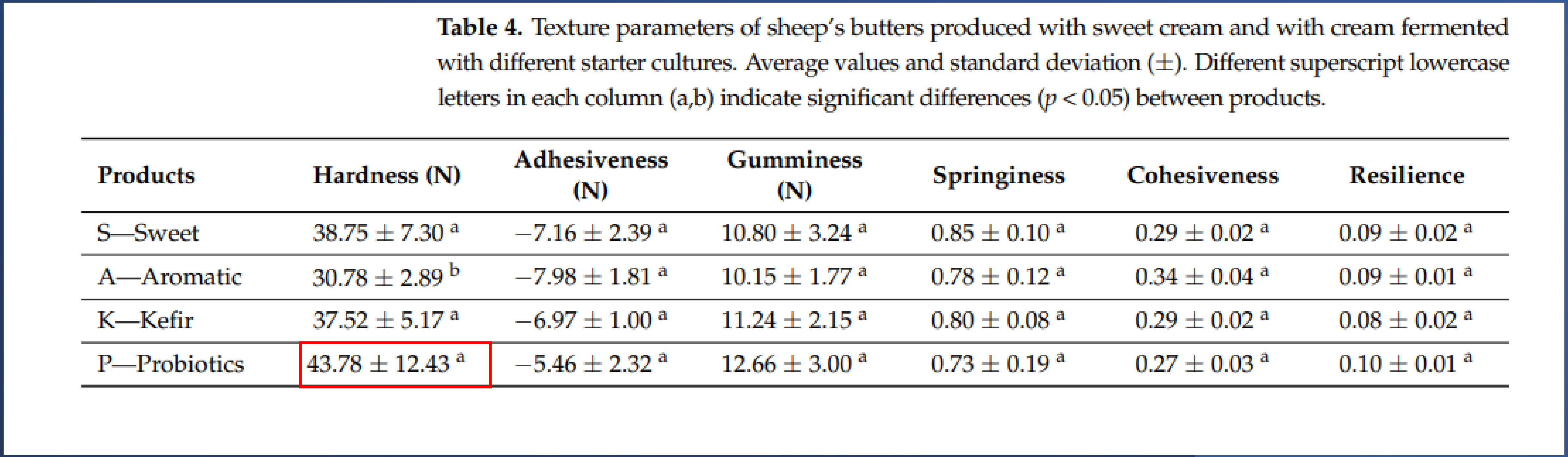


Table 4. Texture parameters of sheep's butters produced with sweet cream and with cream fermented with different starter cultures. Average values and standard deviation (±). Different superscript lowercase letters in each column (a,b) indicate significant differences ($p < 0.05$) between products.

Products	**Hardness (N)**	**Adhesiveness (N)**	**Gumminess (N)**	**Springiness**	**Cohesiveness**	**Resilience**
S—Sweet	38.75 ± 7.30^{a}	-7.16 ± 2.39^{a}	10.80 ± 3.24^{a}	0.85 ± 0.10^{a}	0.29 ± 0.02^{a}	0.09 ± 0.02^{a}
A—Aromatic	30.78 ± 2.89^{b}	-7.98 ± 1.81^{a}	10.15 ± 1.77^{a}	0.78 ± 0.12^{a}	0.34 ± 0.04^{a}	0.09 ± 0.01^{a}
K—Kefir	37.52 ± 5.17^{a}	-6.97 ± 1.00^{a}	11.24 ± 2.15^{a}	0.80 ± 0.08^{a}	0.29 ± 0.02^{a}	0.08 ± 0.02^{a}
P—Probiotics	43.78 ± 12.43^{a}	-5.46 ± 2.32^{a}	12.66 ± 3.00^{a}	0.73 ± 0.19^{a}	0.27 ± 0.03^{a}	0.10 ± 0.01^{a}

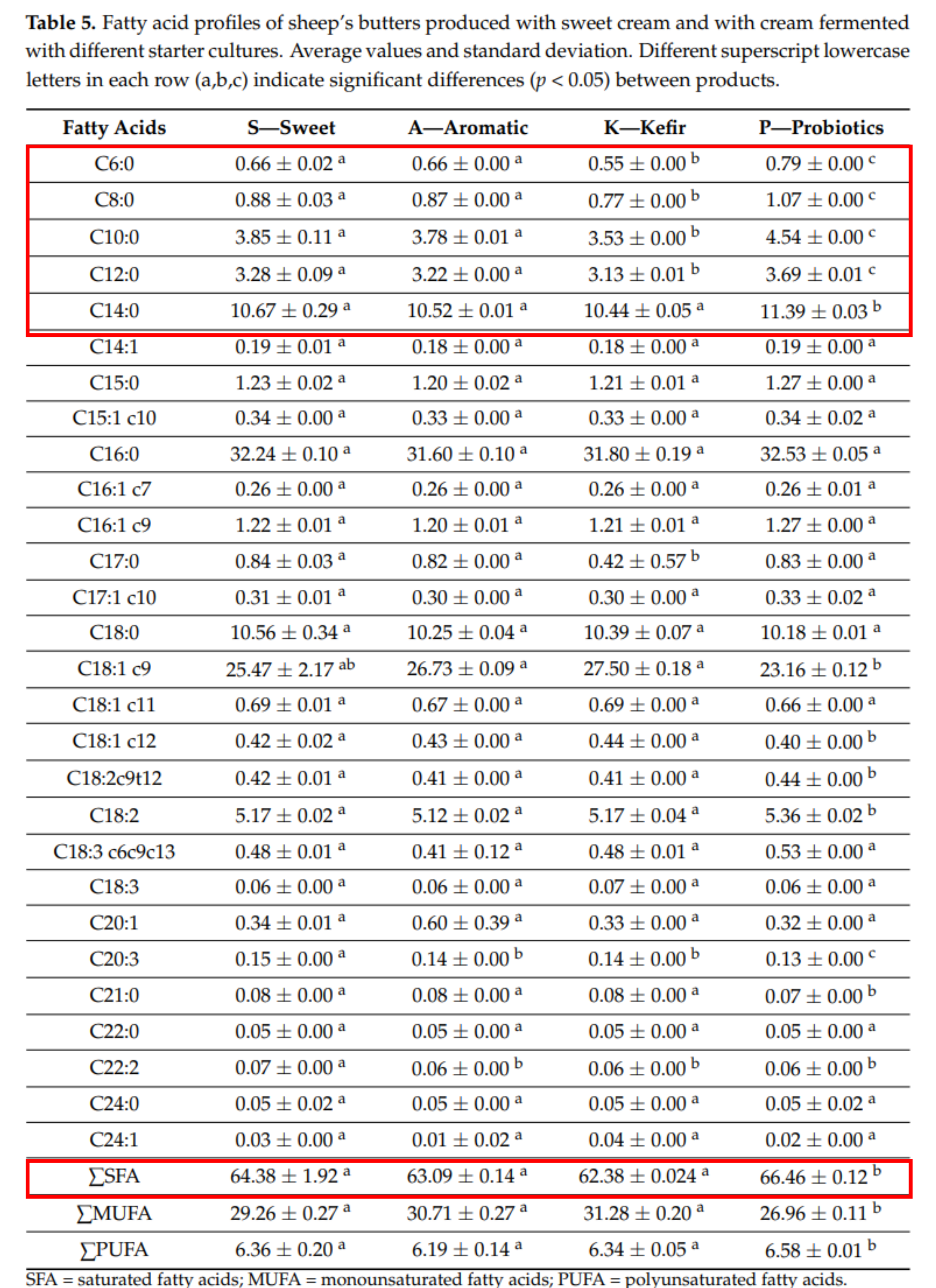
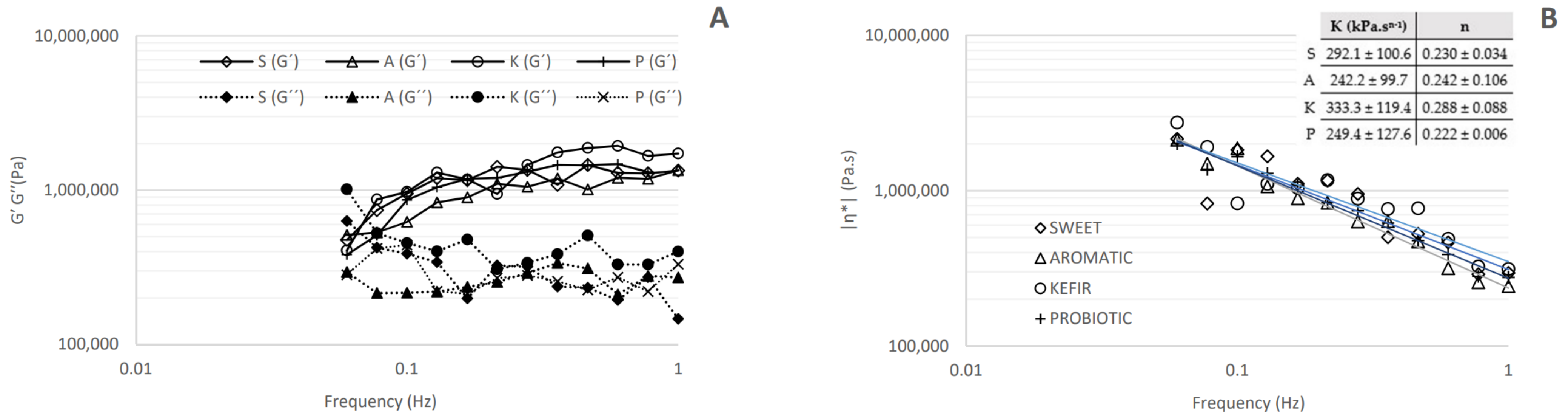


Table 5. Fatty acid profiles of sheep's butters produced with sweet cream and with cream fermented with different starter cultures. Average values and standard deviation. Different superscript lowercase letters in each row (a,b,c) indicate significant differences ($p < 0.05$) between products.

Fatty Acids	S—Sweet	A—Aromatic	K—Kefir	P—Probiotics
C6:0	0.66 ± 0.02 ^{a}	0.66 ± 0.00 ^{a}	0.55 ± 0.00 ^{b}	0.79 ± 0.00 ^{c}
C8:0	0.88 ± 0.03 ^{a}	0.87 ± 0.00 ^{a}	0.77 ± 0.00 ^{b}	1.07 ± 0.00 ^{c}
C10:0	3.85 ± 0.11 ^{a}	3.78 ± 0.01 ^{a}	3.53 ± 0.00 ^{b}	4.54 ± 0.00 ^{c}
C12:0	3.28 ± 0.09 ^{a}	3.22 ± 0.00 ^{a}	3.13 ± 0.01 ^{b}	3.69 ± 0.01 ^{c}
C14:0	10.67 ± 0.29 ^{a}	10.52 ± 0.01 ^{a}	10.44 ± 0.05 ^{a}	11.39 ± 0.03 ^{b}
C14:1	0.19 ± 0.01 ^{a}	0.18 ± 0.00 ^{a}	0.18 ± 0.00 ^{a}	0.19 ± 0.00 ^{a}
C15:0	1.23 ± 0.02 ^{a}	1.20 ± 0.02 ^{a}	1.21 ± 0.01 ^{a}	1.27 ± 0.00 ^{a}
C15:1 c10	0.34 ± 0.00 ^{a}	0.33 ± 0.00 ^{a}	0.33 ± 0.00 ^{a}	0.34 ± 0.02 ^{a}
C16:0	32.24 ± 0.10 ^{a}	31.60 ± 0.10 ^{a}	31.80 ± 0.19 ^{a}	32.53 ± 0.05 ^{a}
C16:1 c7	0.26 ± 0.00 ^{a}	0.26 ± 0.00 ^{a}	0.26 ± 0.00 ^{a}	0.26 ± 0.01 ^{a}
C16:1 c9	1.22 ± 0.01 ^{a}	1.20 ± 0.01 ^{a}	1.21 ± 0.01 ^{a}	1.27 ± 0.00 ^{a}
C17:0	0.84 ± 0.03 ^{a}	0.82 ± 0.00 ^{a}	0.42 ± 0.57 ^{b}	0.83 ± 0.00 ^{a}
C17:1 c10	0.31 ± 0.01 ^{a}	0.30 ± 0.00 ^{a}	0.30 ± 0.00 ^{a}	0.33 ± 0.02 ^{a}
C18:0	10.56 ± 0.34 ^{a}	10.25 ± 0.04 ^{a}	10.39 ± 0.07 ^{a}	10.18 ± 0.01 ^{a}
C18:1 c9	25.47 ± 2.17 ^{ab}	26.73 ± 0.09 ^{a}	27.50 ± 0.18 ^{a}	23.16 ± 0.12 ^{b}
C18:1 c11	0.69 ± 0.01 ^{a}	0.67 ± 0.00 ^{a}	0.69 ± 0.00 ^{a}	0.66 ± 0.00 ^{a}
C18:1 c12	0.42 ± 0.02 ^{a}	0.43 ± 0.00 ^{a}	0.44 ± 0.00 ^{a}	0.40 ± 0.00 ^{b}
C18:2c9t12	0.42 ± 0.01 ^{a}	0.41 ± 0.00 ^{a}	0.41 ± 0.00 ^{a}	0.44 ± 0.00 ^{b}
C18:2	5.17 ± 0.02 ^{a}	5.12 ± 0.02 ^{a}	5.17 ± 0.04 ^{a}	5.36 ± 0.02 ^{b}
C18:3 c6c9c13	0.48 ± 0.01 ^{a}	0.41 ± 0.12 ^{a}	0.48 ± 0.01 ^{a}	0.53 ± 0.00 ^{a}
C18:3	0.06 ± 0.00 ^{a}	0.06 ± 0.00 ^{a}	0.07 ± 0.00 ^{a}	0.06 ± 0.00 ^{a}
C20:1	0.34 ± 0.01 ^{a}	0.60 ± 0.39 ^{a}	0.33 ± 0.00 ^{a}	0.32 ± 0.00 ^{a}
C20:3	0.15 ± 0.00 ^{a}	0.14 ± 0.00 ^{b}	0.14 ± 0.00 ^{b}	0.13 ± 0.00 ^{c}
C21:0	0.08 ± 0.00 ^{a}	0.08 ± 0.00 ^{a}	0.08 ± 0.00 ^{a}	0.07 ± 0.00 ^{b}
C22:0	0.05 ± 0.00 ^{a}	0.05 ± 0.00 ^{a}	0.05 ± 0.00 ^{a}	0.05 ± 0.00 ^{a}
C22:2	0.07 ± 0.00 ^{a}	0.06 ± 0.00 ^{b}	0.06 ± 0.00 ^{b}	0.06 ± 0.00 ^{b}
C24:0	0.05 ± 0.02 ^{a}	0.05 ± 0.00 ^{a}	0.05 ± 0.00 ^{a}	0.05 ± 0.02 ^{a}
C24:1	0.03 ± 0.00 ^{a}	0.01 ± 0.02 ^{a}	0.04 ± 0.00 ^{a}	0.02 ± 0.00 ^{a}
∑SFA	64.38 ± 1.92 ^{a}	63.09 ± 0.14 ^{a}	62.38 ± 0.024 ^{a}	66.46 ± 0.12 ^{b}
∑MUFA	29.26 ± 0.27 ^{a}	30.71 ± 0.27 ^{a}	31.28 ± 0.20 ^{a}	26.96 ± 0.11 ^{b}
∑PUFA	6.36 ± 0.20 ^{a}	6.19 ± 0.14 ^{a}	6.34 ± 0.05 ^{a}	6.58 ± 0.01 ^{b}

SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids.



	K (kPa.s^{n-1})	n
S	292.1 ± 100.6	0.230 ± 0.034
A	242.2 ± 99.7	0.242 ± 0.106
K	333.3 ± 119.4	0.288 ± 0.088
P	249.4 ± 127.6	0.222 ± 0.006

Figure 2. Rheological parameters of sheep′s butters produced with sweet cream (S) and cream fermented with aromatic starter culture (A), kefir (K) and probiotics (P). (**A**) Elastic (G′) and viscous (G″) moduli; (**B**) complex viscosity. According to power law model (Equation (2)) consistency index (*K*) and power law index (*n*).

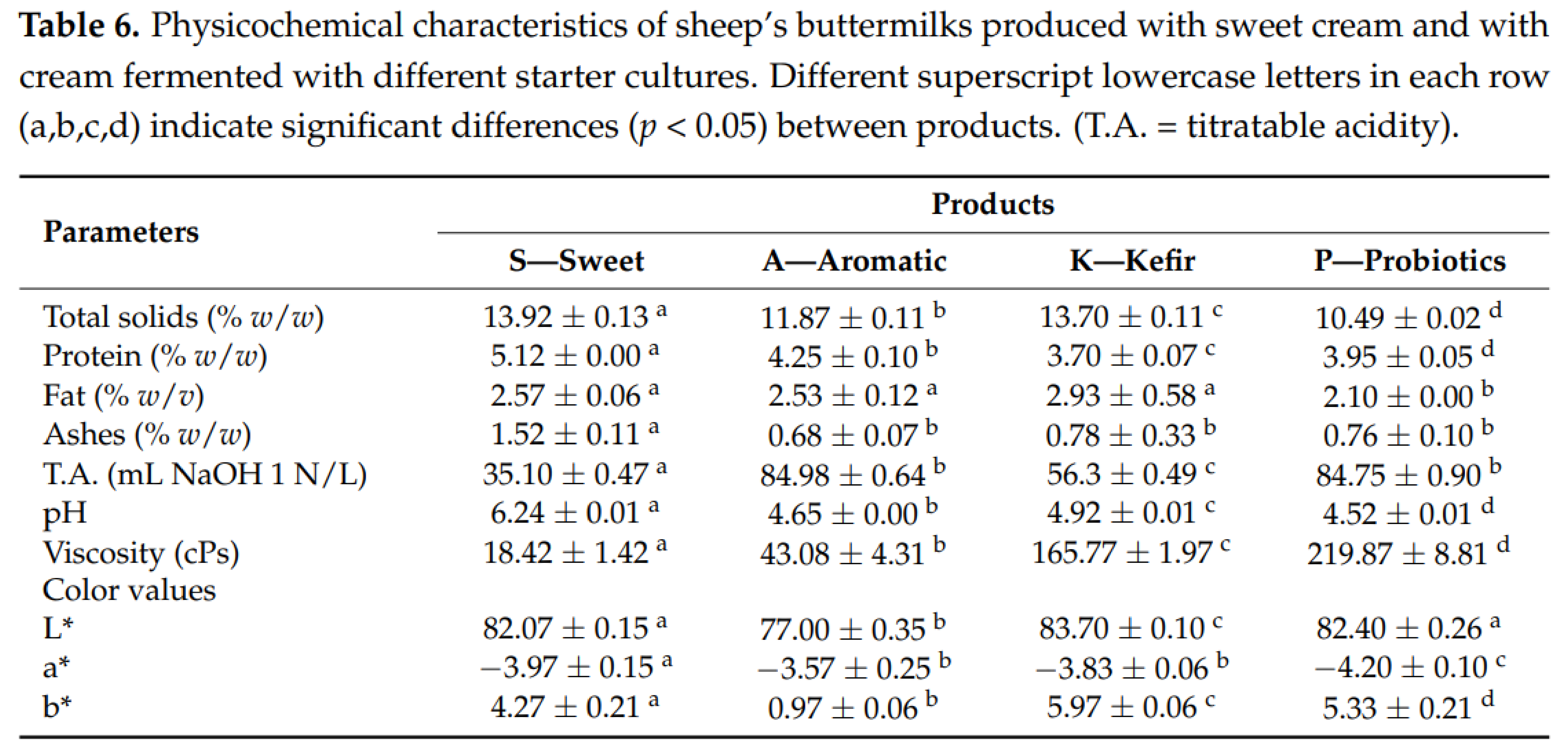


Table 6. Physicochemical characteristics of sheep's buttermilks produced with sweet cream and with cream fermented with different starter cultures. Different superscript lowercase letters in each row (a,b,c,d) indicate significant differences ($p < 0.05$) between products. (T.A. = titratable acidity).

Parameters	Products			
	S—Sweet	**A—Aromatic**	**K—Kefir**	**P—Probiotics**
Total solids (% *w*/*w*)	13.92 ± 0.13 ^{a}	11.87 ± 0.11 ^{b}	13.70 ± 0.11 ^{c}	10.49 ± 0.02 ^{d}
Protein (% *w*/*w*)	5.12 ± 0.00 ^{a}	4.25 ± 0.10 ^{b}	3.70 ± 0.07 ^{c}	3.95 ± 0.05 ^{d}
Fat (% *w*/*v*)	2.57 ± 0.06 ^{a}	2.53 ± 0.12 ^{a}	2.93 ± 0.58 ^{a}	2.10 ± 0.00 ^{b}
Ashes (% *w*/*w*)	1.52 ± 0.11 ^{a}	0.68 ± 0.07 ^{b}	0.78 ± 0.33 ^{b}	0.76 ± 0.10 ^{b}
T.A. (mL NaOH 1 N/L)	35.10 ± 0.47 ^{a}	84.98 ± 0.64 ^{b}	56.3 ± 0.49 ^{c}	84.75 ± 0.90 ^{b}
pH	6.24 ± 0.01 ^{a}	4.65 ± 0.00 ^{b}	4.92 ± 0.01 ^{c}	4.52 ± 0.01 ^{d}
Viscosity (cPs)	18.42 ± 1.42 ^{a}	43.08 ± 4.31 ^{b}	165.77 ± 1.97 ^{c}	219.87 ± 8.81 ^{d}
Color values				
L*	82.07 ± 0.15 ^{a}	77.00 ± 0.35 ^{b}	83.70 ± 0.10 ^{c}	82.40 ± 0.26 ^{a}
a*	−3.97 ± 0.15 ^{a}	−3.57 ± 0.25 ^{b}	−3.83 ± 0.06 ^{b}	−4.20 ± 0.10 ^{c}
b*	4.27 ± 0.21 ^{a}	0.97 ± 0.06 ^{b}	5.97 ± 0.06 ^{c}	5.33 ± 0.21 ^{d}

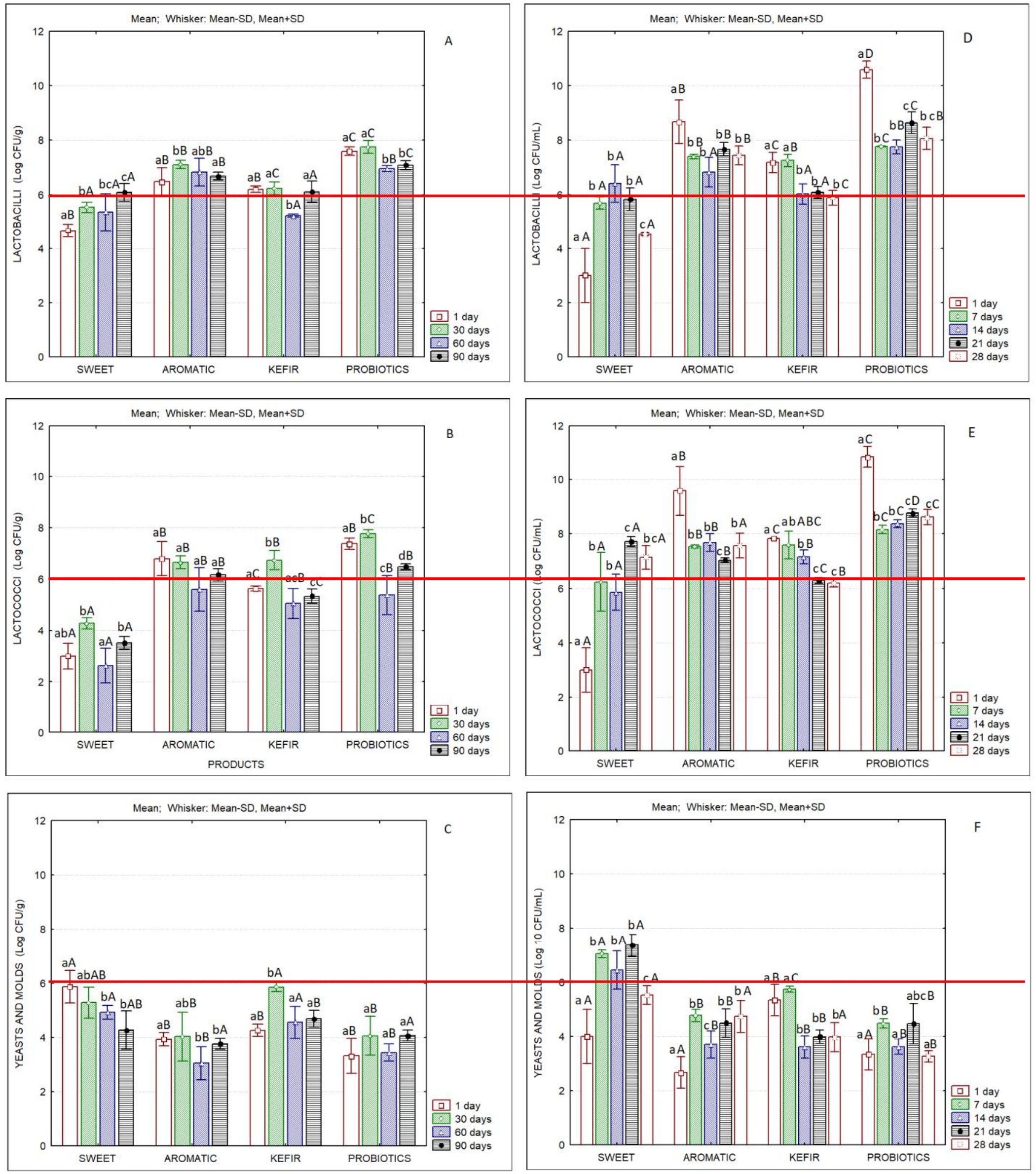
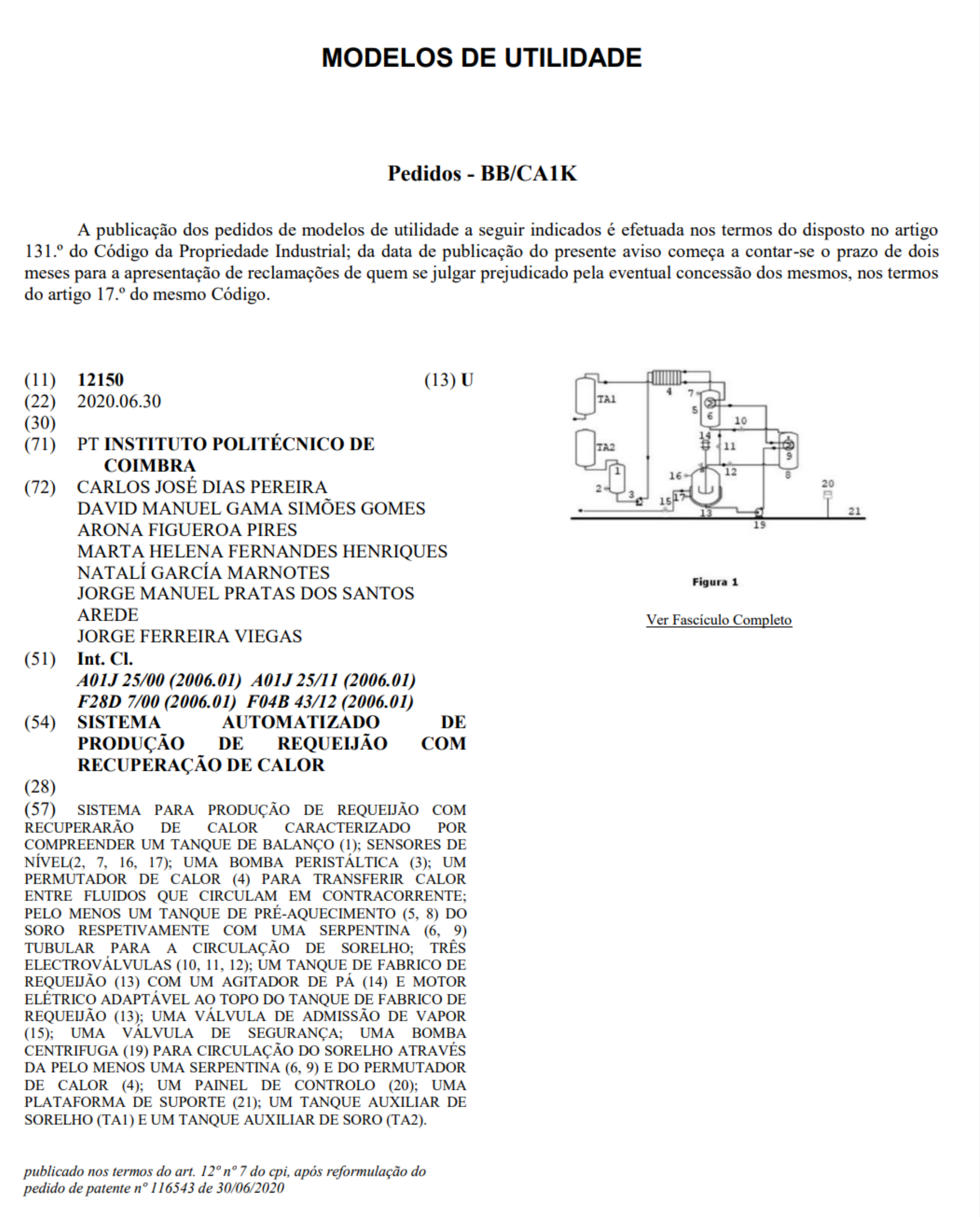


Figure 3. Microbiological characteristics of sheep's butters and correspondent buttermilks produced with sweet cream and with cream fermented with different starter cultures. (**A**) lactobacilli in butter; (**B**) lactococci in butter; (**C**) yeasts and molds in butter; (**D**) lactobacilli in buttermilk; (**E**) lactococci in buttermilk; (**F**) yeasts and molds in buttermilk; different lowercase letters (a,b,c,d) indicate significant differences ($p < 0.05$) between days of storage; different capital letters (A,B,C,D) indicate significant differences ($p < 0.05$) between products at the same storage day.

Recuperação de energia no processo de fabrico de requeijão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MODELOS DE UTILIDADE

Pedidos - BB/CA1K

A publicação dos pedidos de modelos de utilidade a seguir indicados é efetuada nos termos do disposto no artigo 131.º do Código da Propriedade Industrial; da data de publicação do presente aviso começa a contar-se o prazo de dois meses para a apresentação de reclamações de quem se julgar prejudicado pela eventual concessão dos mesmos, nos termos do artigo 17.º do mesmo Código.

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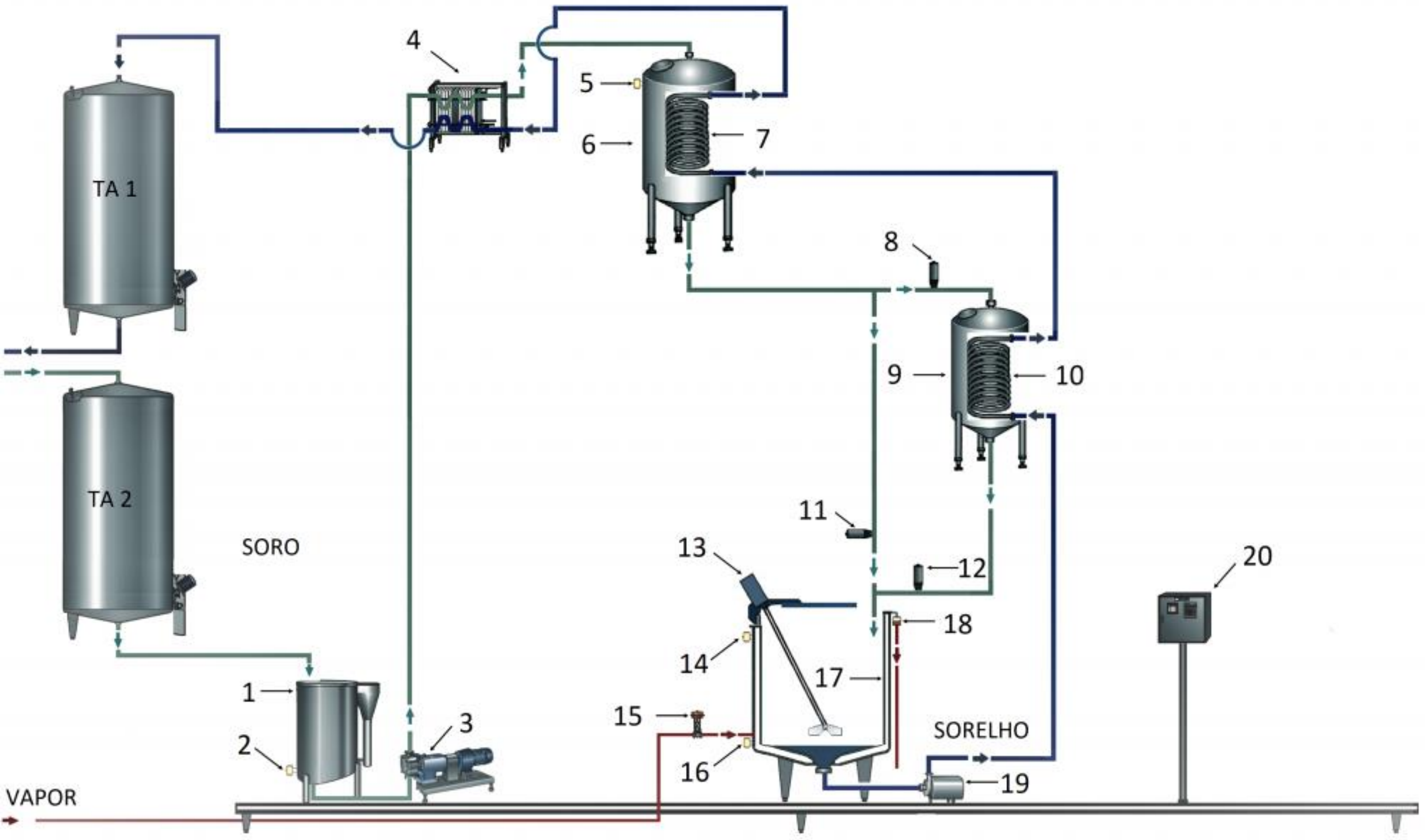
JORGE MANUEL PRATAS DOS SANTOS AREDE
JORGE FERREIRA VIEGAS
(51) **Int. Cl.**
A01J 25/00 (2006.01) A01J 25/11 (2006.01)
F28D 7/00 (2006.01) F04B 43/12 (2006.01)
(54) **SISTEMA AUTOMATIZADO DE PRODUÇÃO DE REQUEIJÃO COM RECUPERAÇÃO DE CALOR**
(28)
(57) SISTEMA PARA PRODUÇÃO DE REQUEIJÃO COM RECUPERARÃO DE CALOR CARACTERIZADO POR COMPREENDER UM TANQUE DE BALANÇO (1); SENSORES DE NÍVEL(2, 7, 16, 17); UMA BOMBA PERISTÁLTICA (3); UM PERMUTADOR DE CALOR (4) PARA TRANSFERIR CALOR ENTRE FLUIDOS QUE CIRCULAM EM CONTRACORRENTE; PELO MENOS UM TANQUE DE PRÉ-AQUECIMENTO (5, 8) DO SORO RESPETIVAMENTE COM UMA SERPENTINA (6, 9) TUBULAR PARA A CIRCULAÇÃO DE SORELHO; TRÊS ELECTROVÁLVULAS (10, 11, 12); UM TANQUE DE FABRICO DE REQUEIJÃO (13) COM UM AGITADOR DE PÁ (14) E MOTOR ELÉTRICO ADAPTÁVEL AO TOPO DO TANQUE DE FABRICO DE REQUEIJÃO (13); UMA VÁLVULA DE ADMISSÃO DE VAPOR (15); UMA VÁLVULA DE SEGURANÇA; UMA BOMBA CENTRIFUGA (19) PARA CIRCULAÇÃO DO SORELHO ATRAVÉS DA PELO MENOS UMA SERPENTINA (6, 9) E DO PERMUTADOR DE CALOR (4); UM PAINEL DE CONTROLO (20); UMA PLATAFORMA DE SUPORTE (21); UM TANQUE AUXILIAR DE SORELHO (TA1) E UM TANQUE AUXILIAR DE SORO (TA2).

Figura 1

Ver Fascículo Completo

publicado nos termos do art. 12º nº 7 do cpi, após reformulação do pedido de patente nº 116543 de 30/06/2020



TA 1
TA 2
SORO
VAPOR
SORELHO
1
2
3
4
5
6
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8
9
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12
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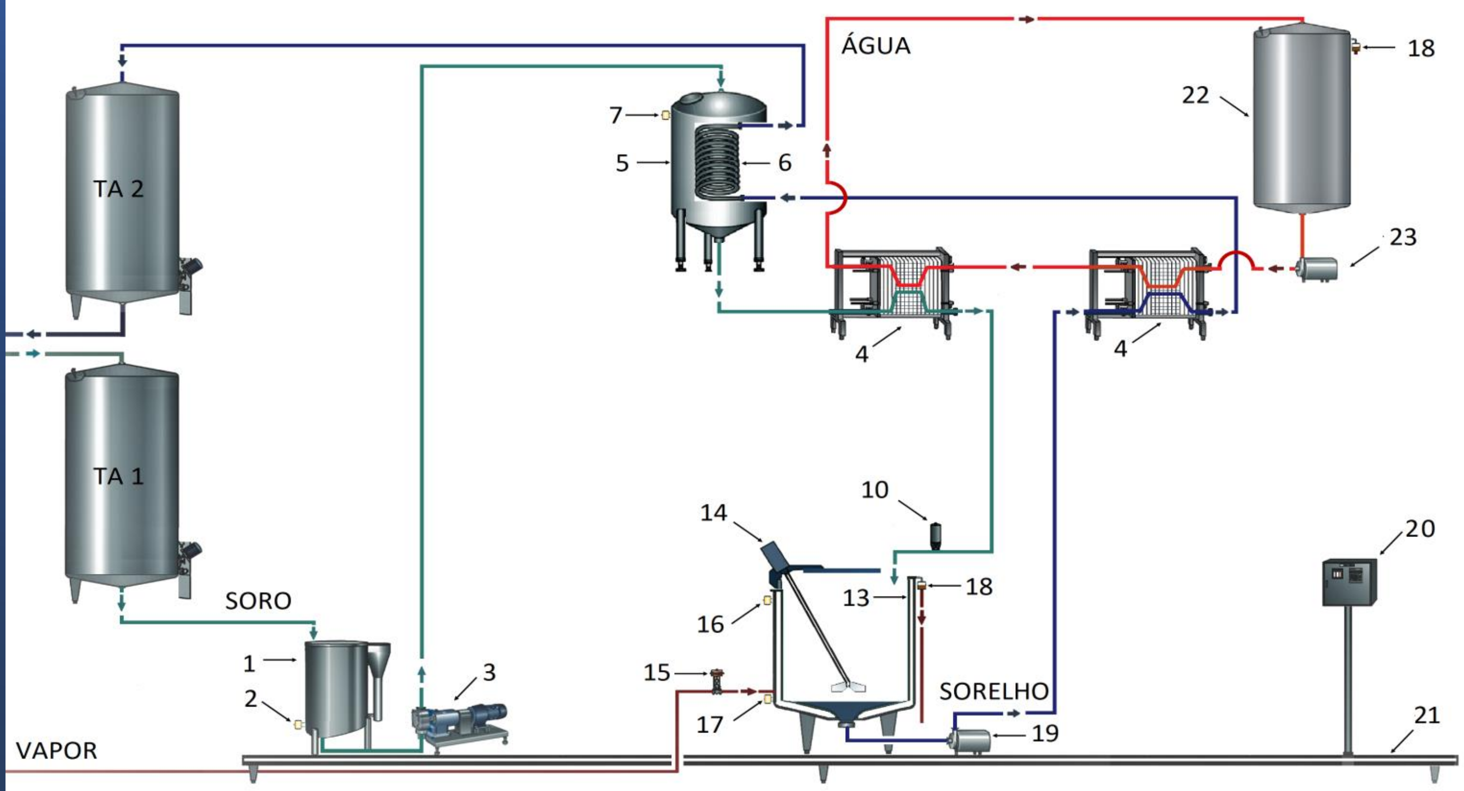
19
20

1- TANQUE DE BALANÇO
2- SENSOR DE NÍVEL 1
3- BOMBA PERISTÁLTICA PARA SORO
4- PERMUTADOR DE CALOR
5- SENSOR DE NIVEL 2
6- TANQUE DE PRÉAQUECIMENTO DE SORO 1
7- SERPENTINA AMOVÍVEL 1
8- ELECTROVÁLVULA 1
9- TANQUE DE PRÉAQUECIMENTO DE SORO 2
10- SERPENTINA AMOVÍVEL 2
11- ELECTROVÁLVULA 2
12- ELECTROVÁLVULA 3
13- AGITADOR DE PÁ
14- SENSOR DE NÍVEL 3
15- VÁLVULA DE ADMISSÃO DE VAPOR
16- SENSOR DE NÍVEL 4
17- TANQUE DE FABRICO DE REQUEIJÃO
18- VÁLVULA DE SEGURANÇA
19- BOMBA DE CIRCULAÇÃO DE SORELHO
20- QUADRO DE CONTROLO


ÁGUA
18
22
7
5
6
TA 2
23
4
4
TA 1
10
14
20
SORO
13
18
16
1
3
15
2
SORELHO
17
19
21
VAPOR

1- TANQUE DE BALANÇO
2- SENSOR DE NÍVEL 1
3- BOMBA PERISTÁLTICA PARA SORO
4- PERMUTADOR DE CALOR (1 E 2)
5- TANQUE DE PRÉAQUECIMENTO DE SORO
6- SERPENTINA AMOVÍVEL
7- SENSOR DE NÍVEL 2
10- ELETROVÁLVULA
13- TANQUE DE FABRICO DE REQUEIJÃO
14- AGITADOR DE PÁ
15- VÁLVULA DE ADMISSÃO DE VAPOR
16- SENSOR DE NÍVEL 3
17- SENSOR DE NÍVEL 4
18- VÁLVULA DE SEGURANÇA
19- BOMBA DE CIRCULAÇÃO DE SORELHO
20- QUADRO DE CONTROLO
21- PLATAFORMA DE APOIO
22- BOMBA DE CIRCULAÇÃO DE ÁGUA
23- TERMOACUMULADOR

Escola Superior Agrária

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