

ASSESSMENT OF THE PROTEINS FROM WHEY AND ITS MICROPARTICULATED AND FERMENTED PRODUCTS

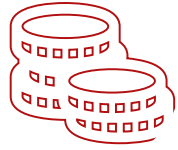
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Session 59 - Milk properties for the valorization of dairy (by-products) manufacturing
Abstract #2213659

BACKGROUND



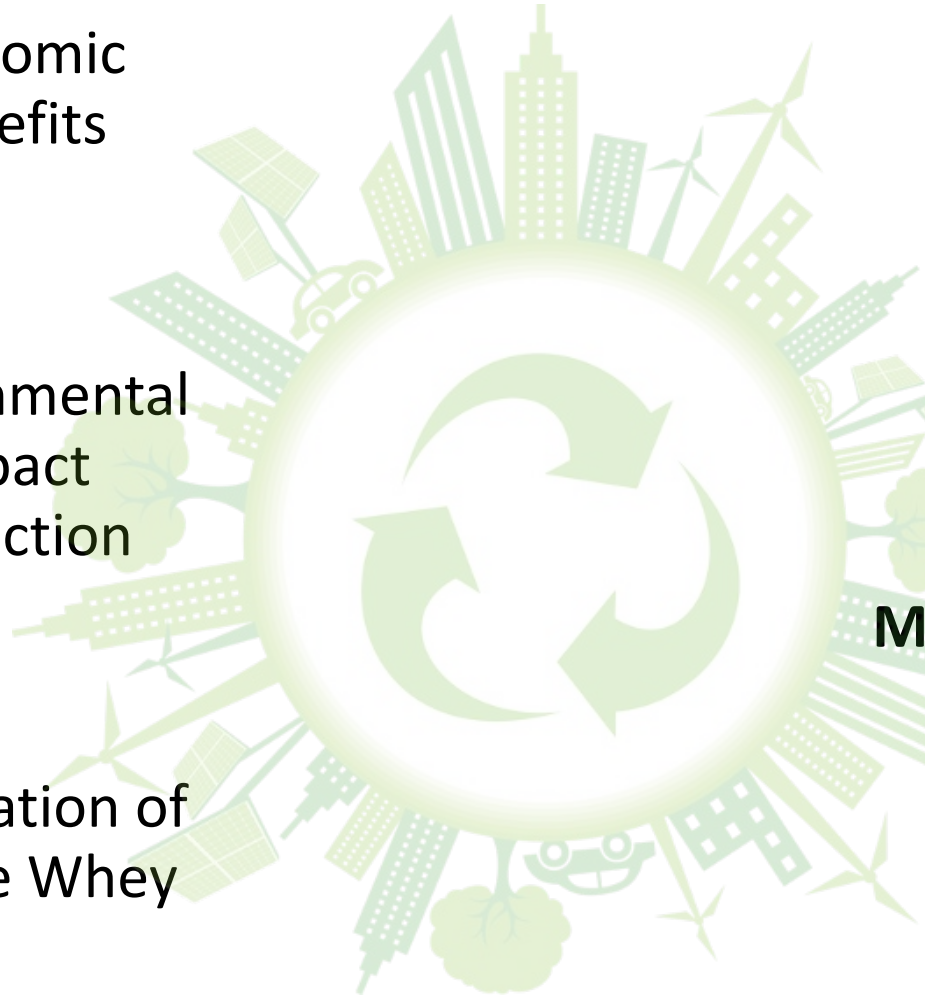
Economic
Benefits



Environmental
Impact
Reduction



Valorization of
Cheese Whey



Circular Economy implementation

Dairy by-products → **whey protein**

Massive dairy residue worldwide
160.7 million m³ year⁻¹

GOT WHEY? HOW TO RECYCLE WHEY PROTEIN?

Micro-
particulation
technique

Fermentation

«Soft cream»
product



AIM

ASSESSMENT OF THE CHEMICAL AND PROTEINS MICROSTRUCTURAL CHANGES TROUGHT NATIVE **WHEY** TO A **MICROPARTICULATED AND FERMENTED PRODUCT** («*SOFT CREAM*»)

MATERIALS AND METHODS

**Whey
collection**

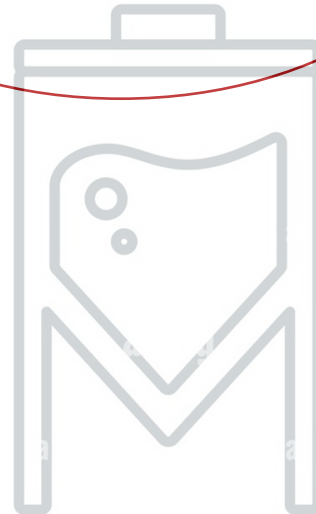
**Micro-
particulation**

Fermentation

- Lyofast MOS 062 C Sacco System
- -BLC 1 Sacco System

**Chemical
analysis**

**Microstructural
analysis**



Sample size: $n=8$ x whey types

ANALYTICAL METHODS

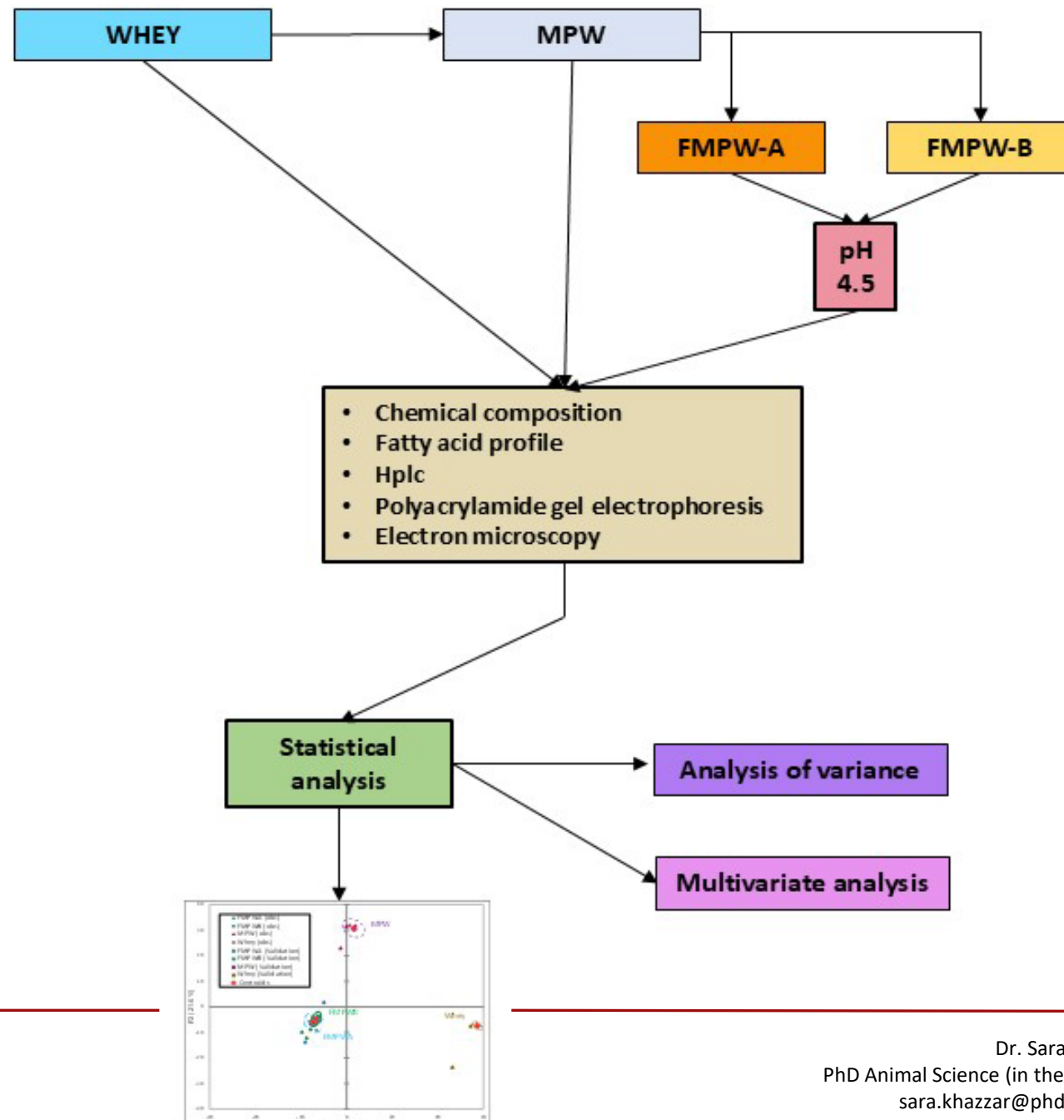
Chemical Composition

- Crude protein (CP), crude fat, ethereal extract (EE) by AOAC methods.
- Lactose, glucose, and galactose by HPLC with RIDF
- Fatty acid profile (GC-FID analysis)

Protein macrostructure

- Protein fractions (SDS-PAGE electrophoresis)
- Transmission electron microscope (TEM – TECNAI G2, FEI) assesment

GRAPHICAL ABSTRACT



CHEMICAL TRAITS (g/100g)

Effect of microparticulation (MPW) and fermentations (FMPW) of native whey (WHEY) on chemical composition (g / 100 g on wet weight)

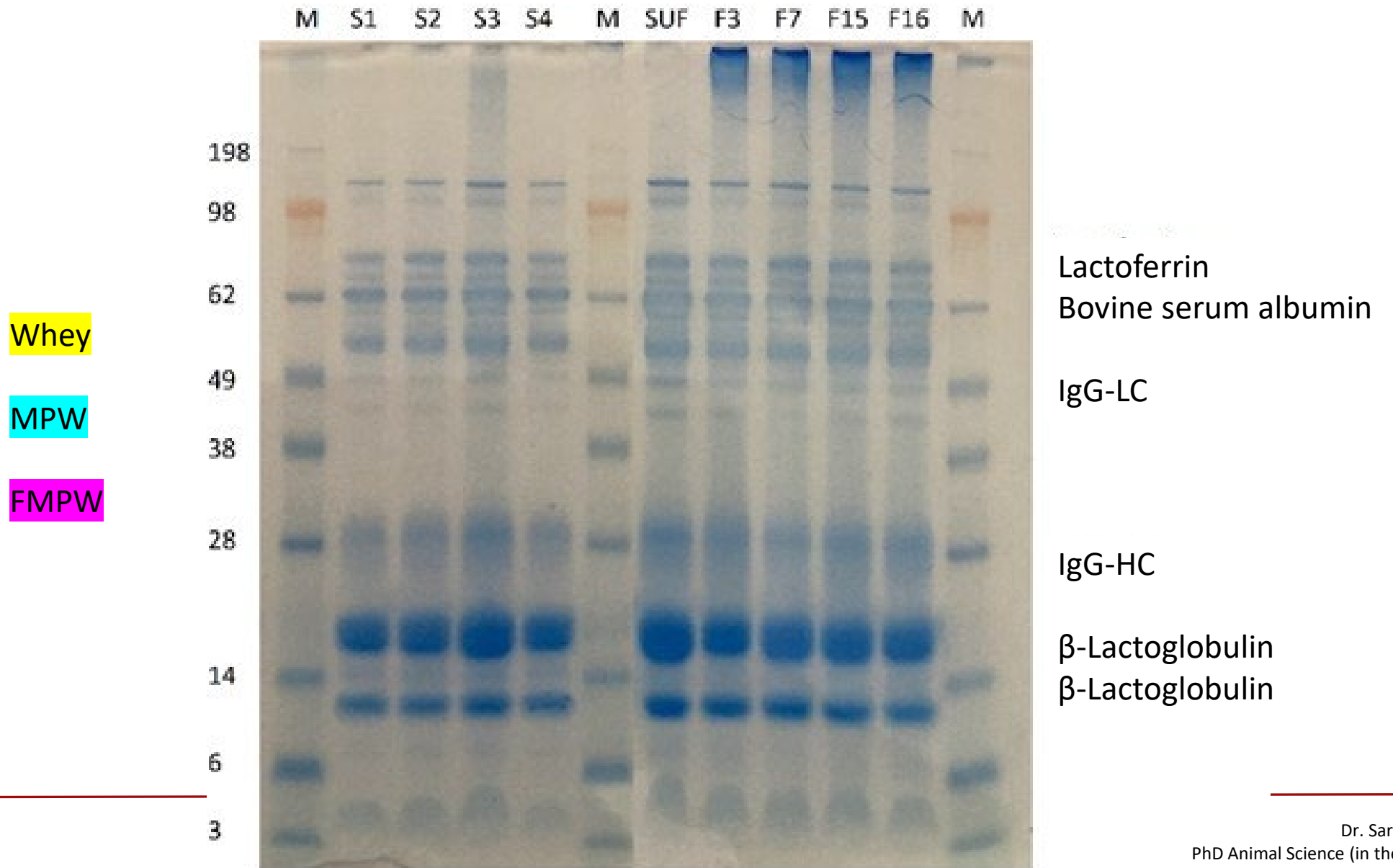
	Whey-products				SEM	p
	WHEY	MPW	FMPWA	FMPWB		
Crude protein	0.6 ^b	8.8 ^a	8.8 ^a	8.8 ^a	0.3	0.001
Crude fat	0.2 ^b	1.1 ^a	1.1 ^a	1.1 ^a	0.2	0.001
Lactose	2.6	2.8	2.5	2.5	0.1	0.318
Galactose	0.29 ^{ab}	0.21 ^b	0.38 ^a	0.38 ^a	0.03	0.001
Glucose	0.19 ^a	0.14 ^{ab}	0.10 ^b	0.10 ^b	0.02	0.001

SEM, standard error of the means. a-b LSMs in a row without a common superscript differ ($p < 0.05$).

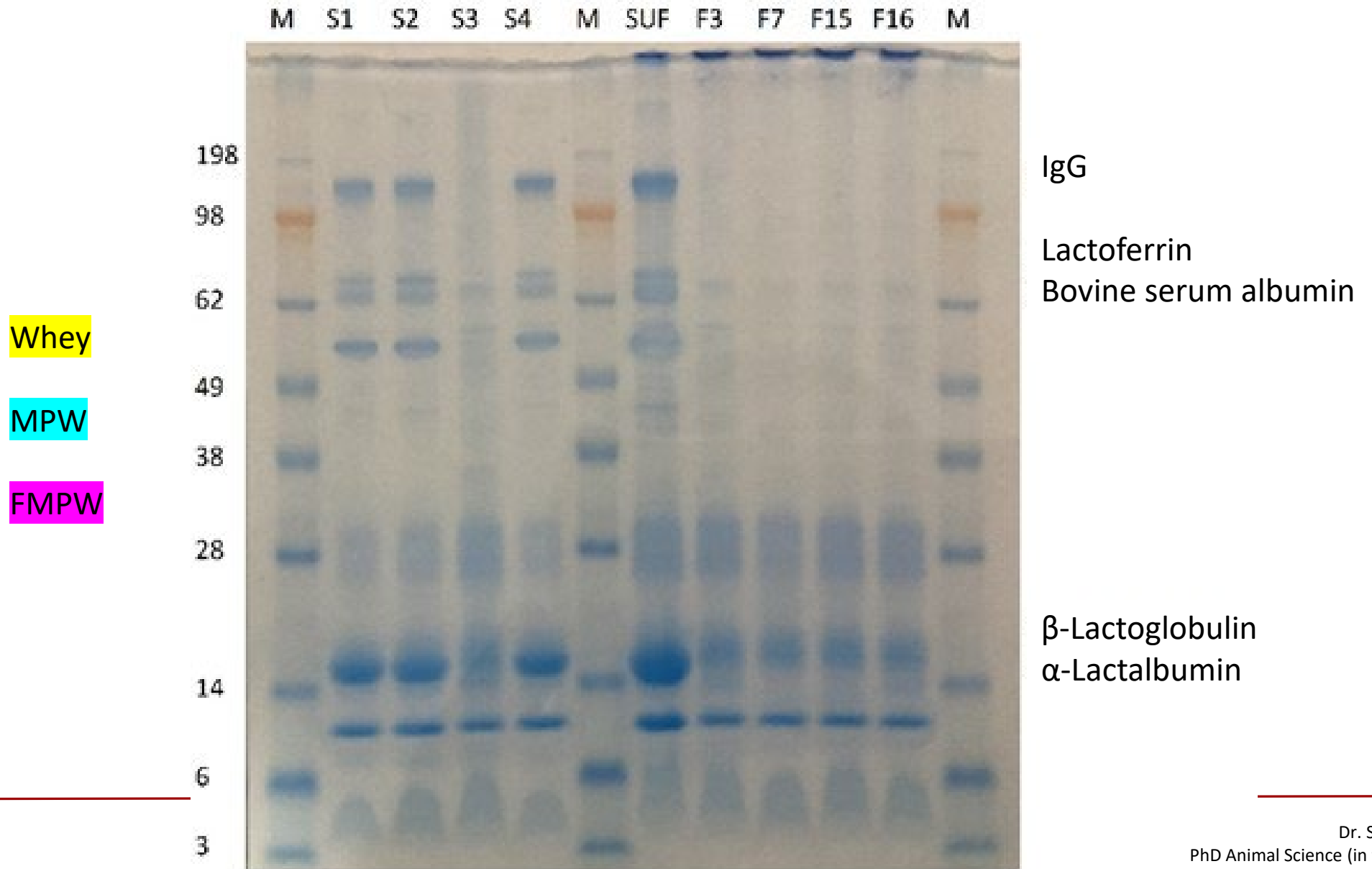
Starter A: *Lactococcus lactis* ssp. *lactis* and *Streptococcus thermophilus*

Starter B: *Bifidobacterium animalis* ssp. *lactis*.

SDS-PAGE REDUCING CONDITIONS



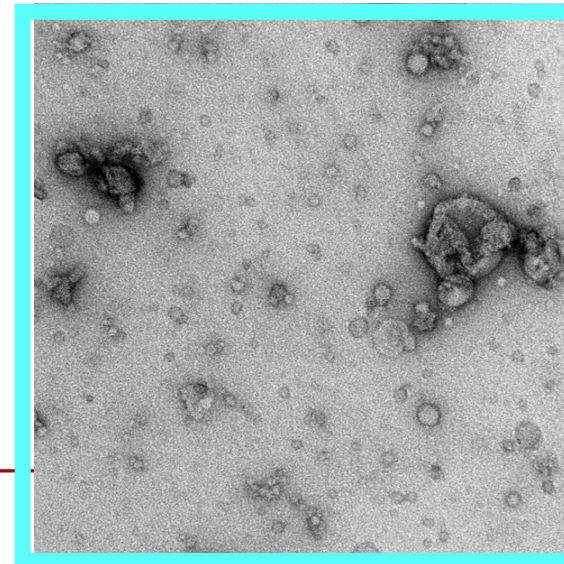
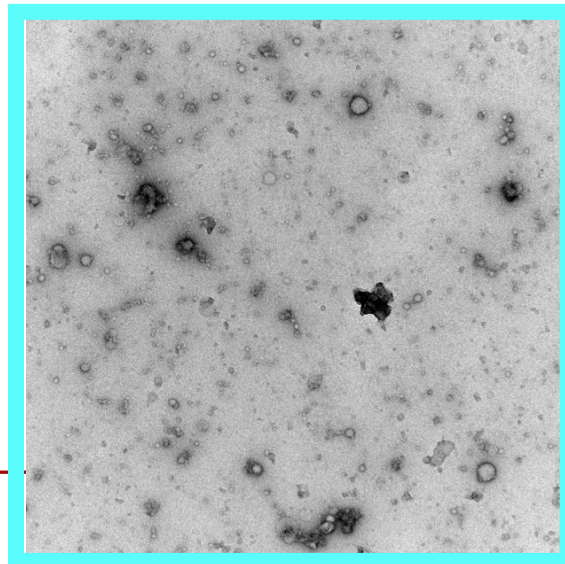
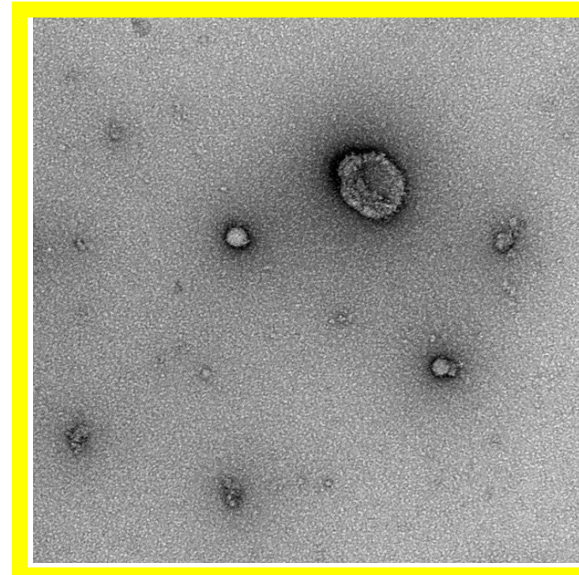
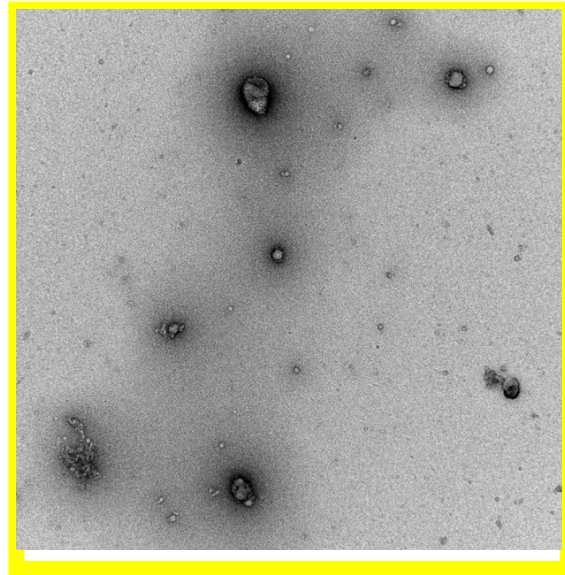
SDS-PAGE NON- REDUCING CONDITIONS



TRANSMISSION ELECTRON MICROSCOPY TECNAI G2 (FEI)

NATIVE WHEY

Mean diameter $0.48 \pm 0.04 \mu\text{m}$



MICROPARTICULATED WHEY

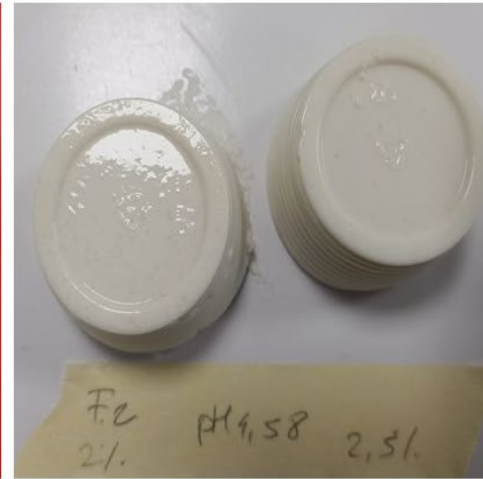
Mean diameter $1.78 \pm 0.004 \mu\text{m}$

«SOFT CREAM»

Samples	Proteins	Fat	Sugars
Whey	0.66	0.07	3.04
FMPW	8.82	1.10	2.98



Whey

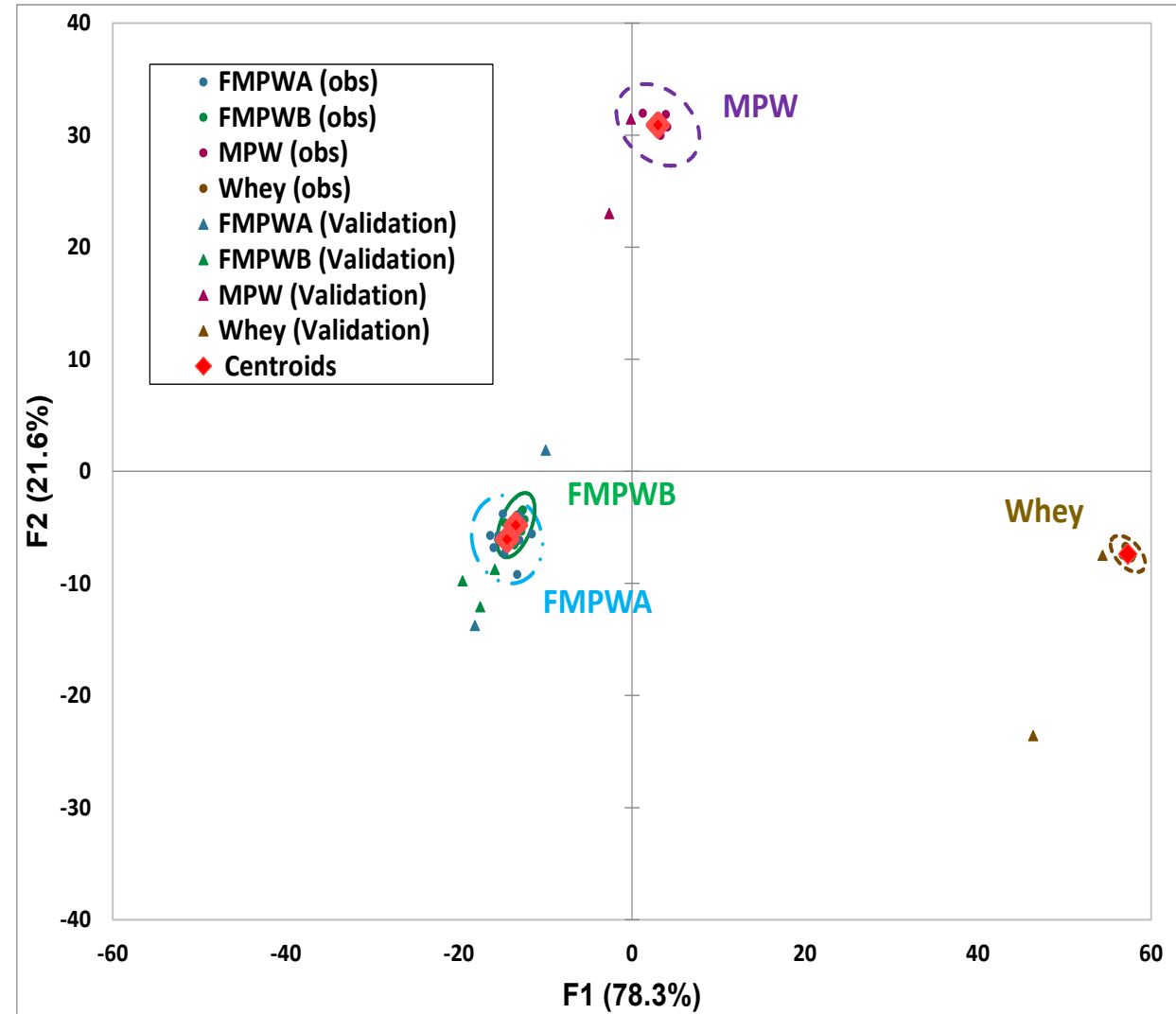
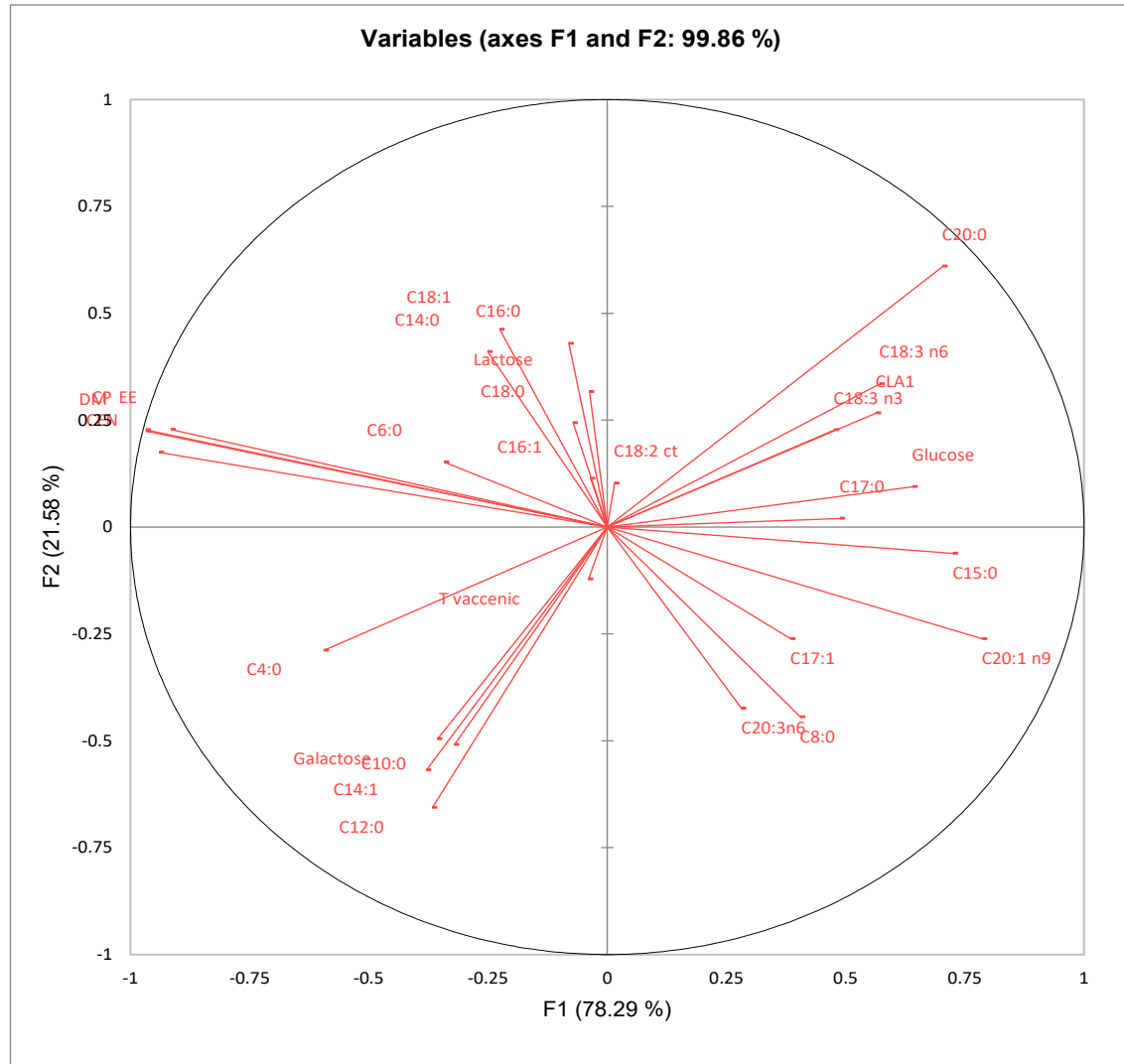


Gelatin-thickened FMPW



Credit:S.Balzan

FUTURE CHALLENGES



METABOLOMIC FINGERPRINTING

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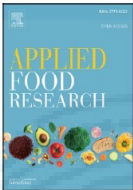


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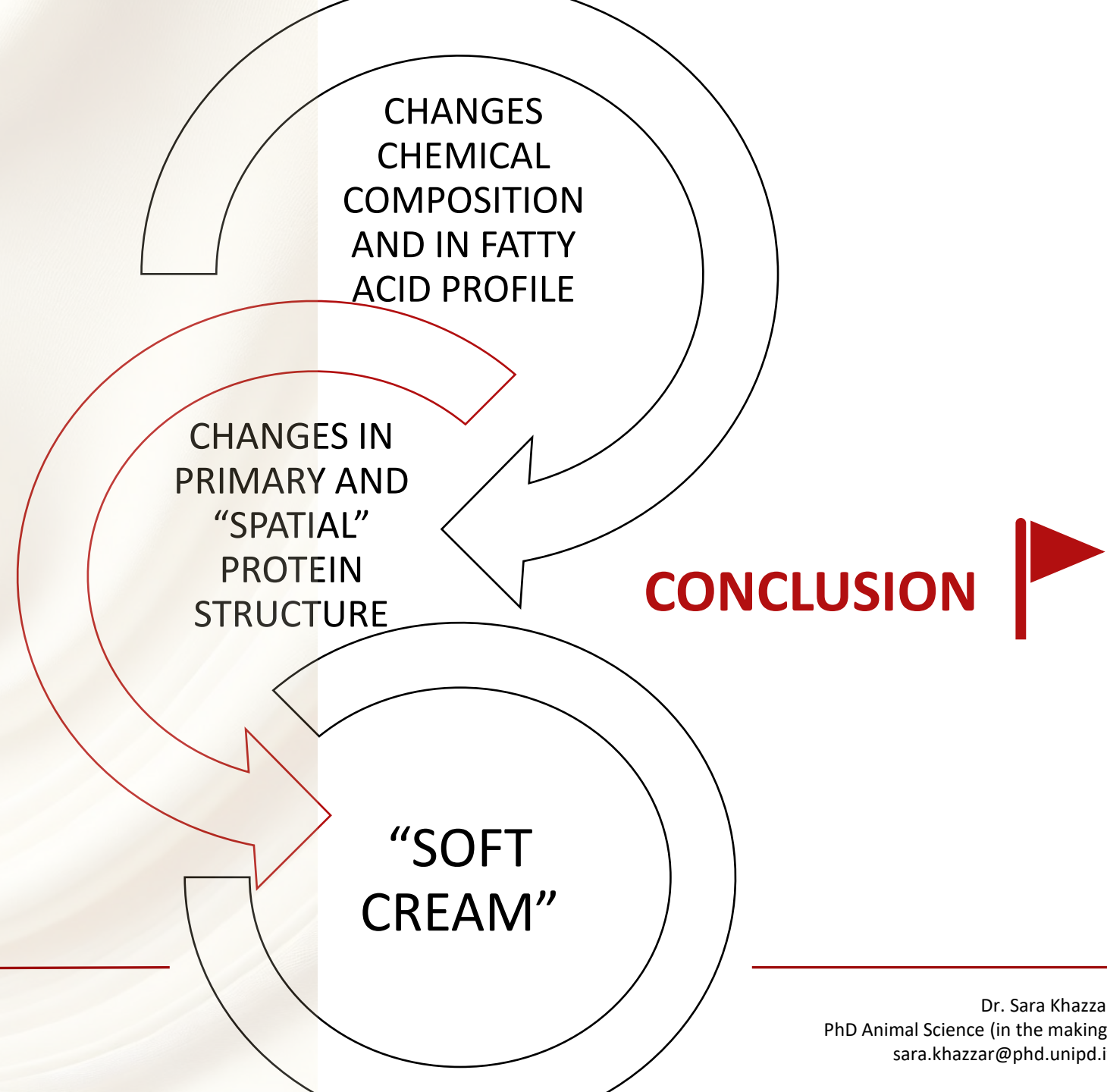
Applied Food Research

journal homepage: www.elsevier.com/locate/afres



DART-HRMS reveals metabolic changes of whey through microparticulation and fermentations

Whey type	<i>m/z</i>	<i>m/z</i> theoretical mass	Error (ppm)	Elemental formula	Type of ion	<i>P</i> _{adj}	Tentative assignment
WHEY	147.0662	147.0663	-0.67	C ₆ H ₁₂ O ₄	[M–H] [–]	2.17e-07	Fatty alcohol
MPW	129.0185	129.0188	-2.33	C ₅ H ₈ O ₅	[M–H–H ₂ O] [–]	1.76e-04	Hydroxyglutaric acid
	133.0141	133.0142	-0.75	C ₄ H ₆ O ₅	[M–H] [–]	8.01e-11	Malic acid
	213.0174	213.0170	1.88	C ₆ H ₁₀ O ₆	[M–Cl] [–]	2.54e-09	Ketogalactose
	215.0327	215.0328	-0.47	C ₆ H ₁₂ O ₆	[M + Cl] [–]	3.60e-08	Galactose
	217.0295	–	–	–	–	7.81e-08	–
	256.0596	256.0593	1.17	C ₈ H ₁₅ NO ₆	[M + Cl] [–]	1.70e-10	N-acetyl-glucosamine
FMPW-A	89.0241	89.0244	-3.36	C ₃ H ₆ O ₃	[M–H] [–]	5.52e-03	Lactic acid
	311.0986	311.0984	0.64	C ₁₁ H ₂₀ O ₁₀	[M–H] [–]	4.29e-11	O-glycosyl compound
FMPW-B	237.0615	237.0616	-0.42	C ₈ H ₁₄ O ₈	[M–H] [–]	1.66e-06	–
	251.0773	251.0780	-2.79	C ₁₀ H ₁₄ N ₄ O ₅	[M–H–H ₂ O] [–]	2.07e-05	Histidyl-aspartic acid
	267.0719	267.0722	-1.12	C ₉ H ₁₆ O ₉	[M–H] [–]	5.87e-07	3-deoxy-D-glycero-D-galacto-2-nonulosonic acid
	269.0878	269.0878	-0.04	C ₁₀ H ₁₄ N ₄ O ₅	[3M–H] [–]	1.30e-09	Lactic acid
	271.0922	271.0930	-2.95	C ₁₁ H ₁₈ N ₂ O ₇	[M–H–H ₂ O] [–]	1.09e-09	–
	297.0828	–	–	–	–	2.30e-11	–



CHANGES
CHEMICAL
COMPOSITION
AND IN FATTY
ACID PROFILE

CHANGES IN
PRIMARY AND
“SPATIAL”
PROTEIN
STRUCTURE

CONCLUSION

“SOFT
CREAM”

THANKS FOR YOUR ATTENTION

