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Conventional and traditional livestock production systems – new challenges

FT-MIR prediction of total antioxidant activity of bovine milk

M. Franzoi, G. Niero, M. Cassandro, and M. De Marchi

Department of Agronomy, Food, Natural Resources, Animals and Environment, University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy

UNIVERSITÀ DEGLI STUDI DI PADOVA

DAFNAE
Department of Agronomy Food
Natural resources Animals Environment

Summary

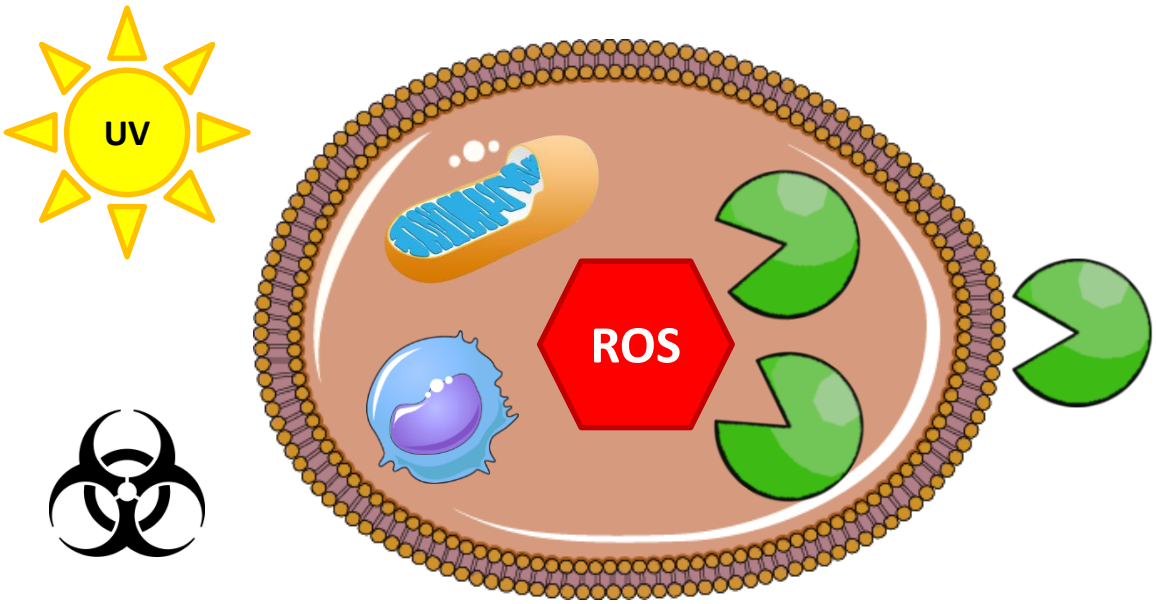
Introduction

Quantification method

FT-MIR calibrations

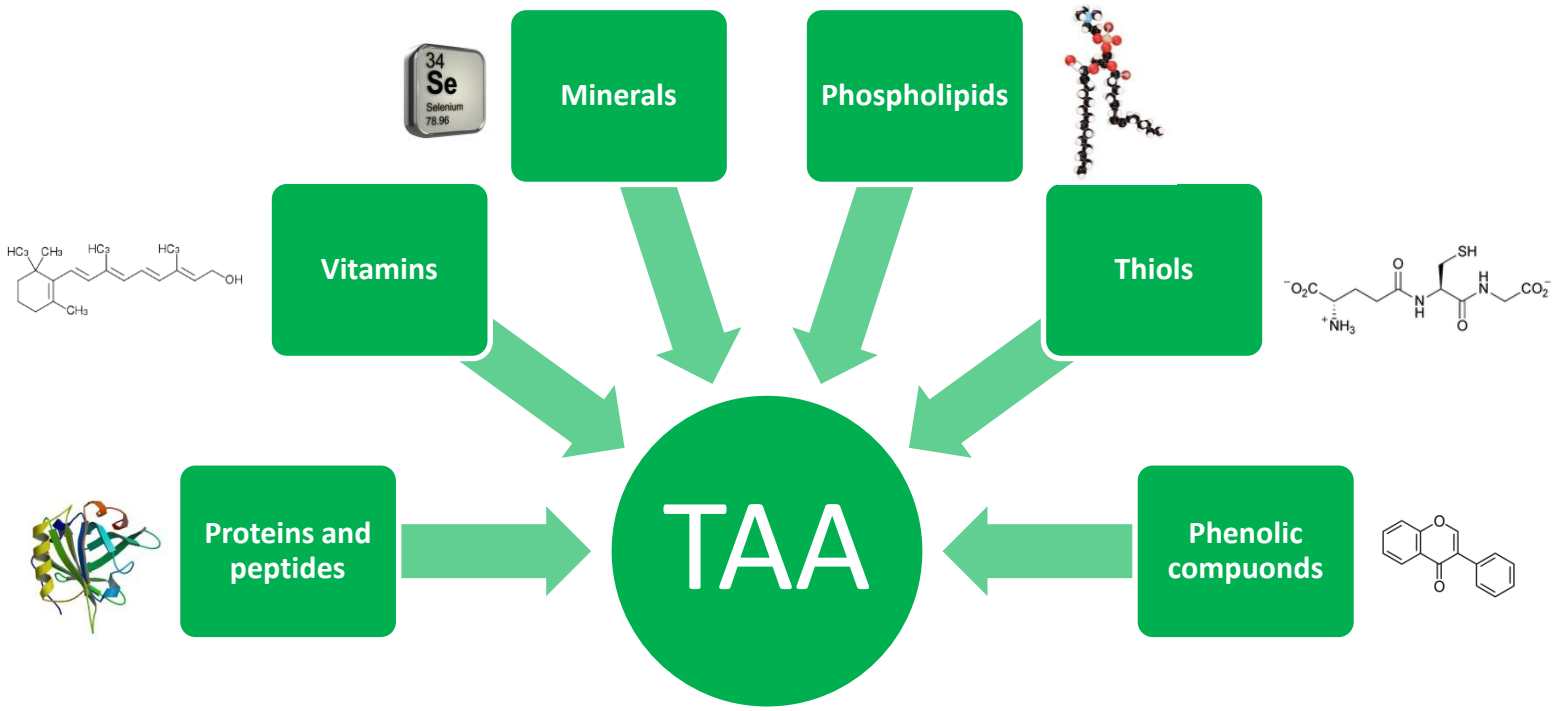
Phenotypic analysis

Introduction: ROS



Mastitis, contributes to an alteration of cow milk oxidative status.

Introduction: antioxidants



Milk is an important source of antioxidants

Several compounds in milk contributes to its antioxidant activity

Provides a defense from oxidative stress for consumers

Prevention of other milk components (i.e. lipids) oxidation

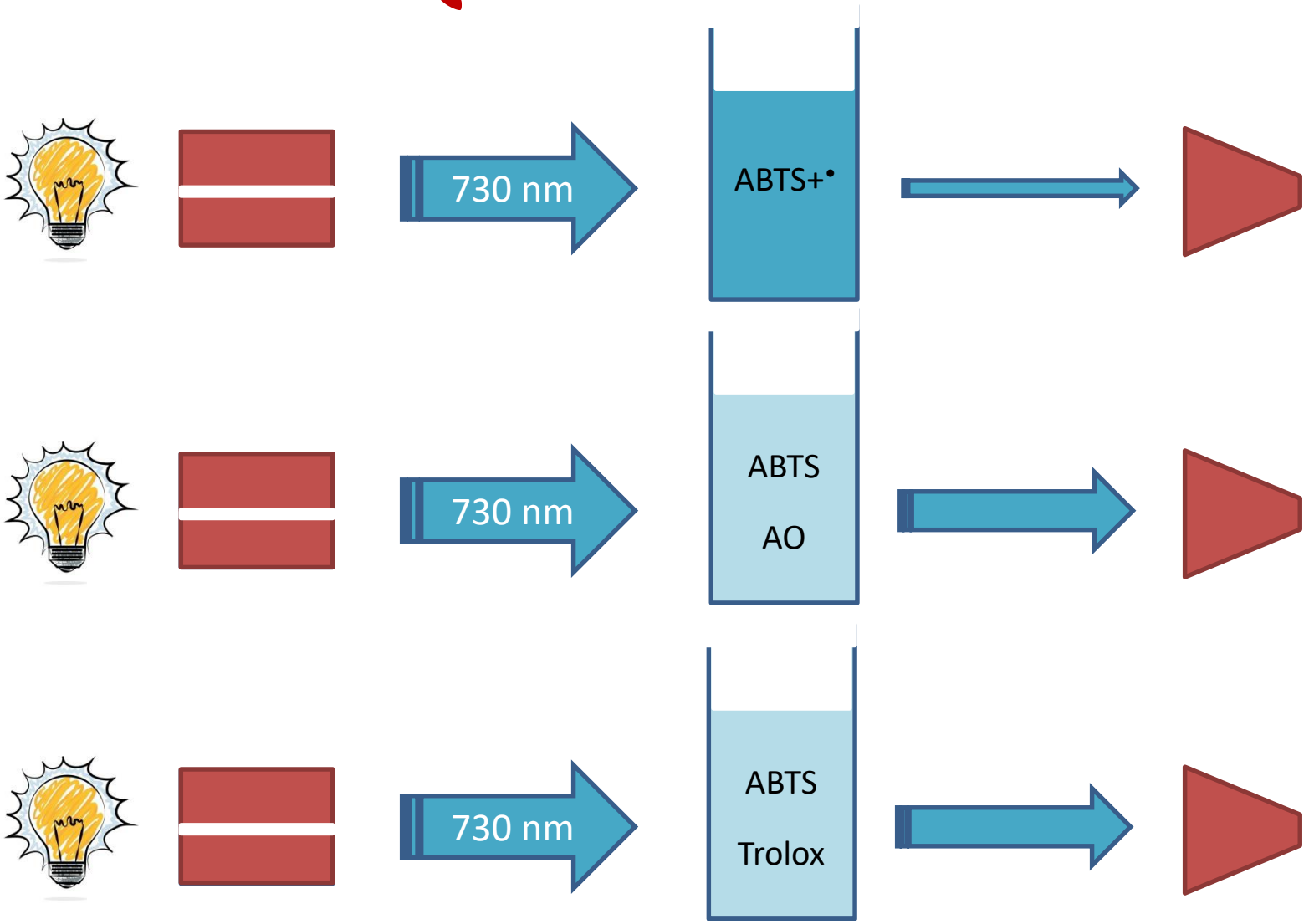
Objectives

Develop a FT-MIR prediction model for Total Antioxidant Activity (TAA) in cow milk.

Reference data + **Spectra** + **UVE-PLS** = **Prediction model**

Study phenotypic variation of TAA of Holstein-Friesian Cows from a large database milk FT-MIR spectra.

Quantification

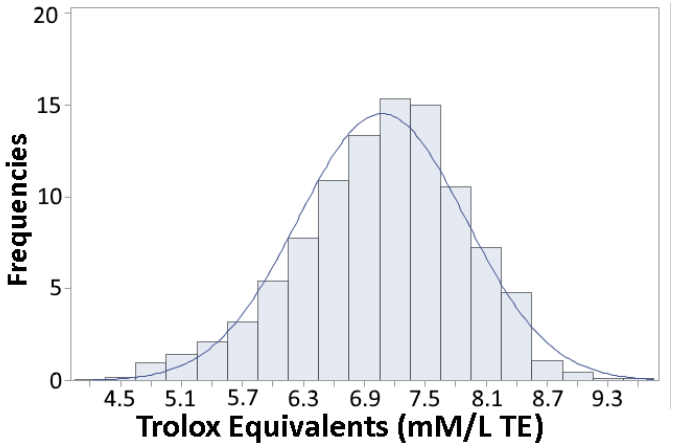


Niero et al.,(2016) Development and validation of a near infrared spectrophotometric method to determine total antioxidant activity of milk. Food Chem.

FT-MIR models

Samples:

1,690
Italian Holstein Friesian
Between 6 – 536 days in milk
Between 1 and 9 parities
From Sept 2017 to Feb 2018
17 herds



Models:

UVE – PLS using SAS (ver. 9.4; SAS Institute Inc., Cary, NC)
LOOCV validation procedure
20 maximum factors

Fitting statistics for the calibration model									
	Mean	SD	#V	#L	R^2_p	SEP	R^2_{cv}	SECV	RPD
TE (mM/L) Trolox Equivalents	7.07	0.82	123	10	0.45	0.61	0.44	0.62	1.33

Phenotypic analysis

Spectra of Holstein Friesian reared in North of Italy

6 – 305 days in milk (10 days classes)

1 – 9 parities (1 - ≥5 classes)

Herds with more than 5 cows

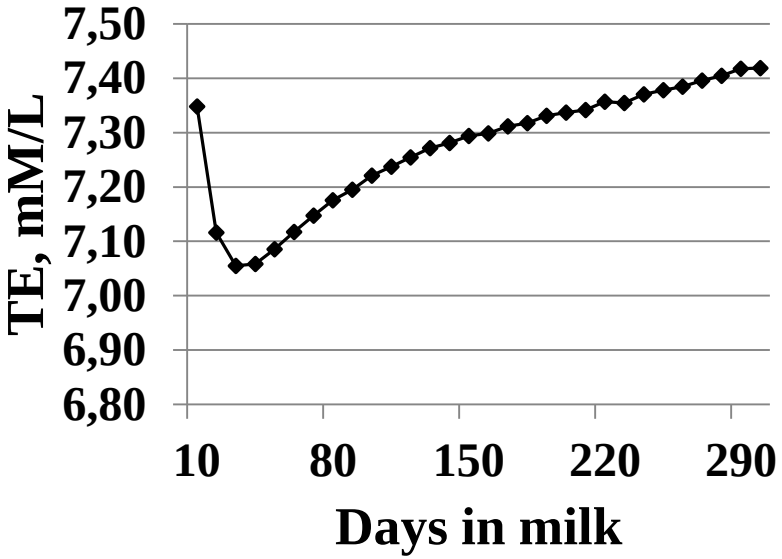
83,482 observations from 6,262 cows and 168 herds

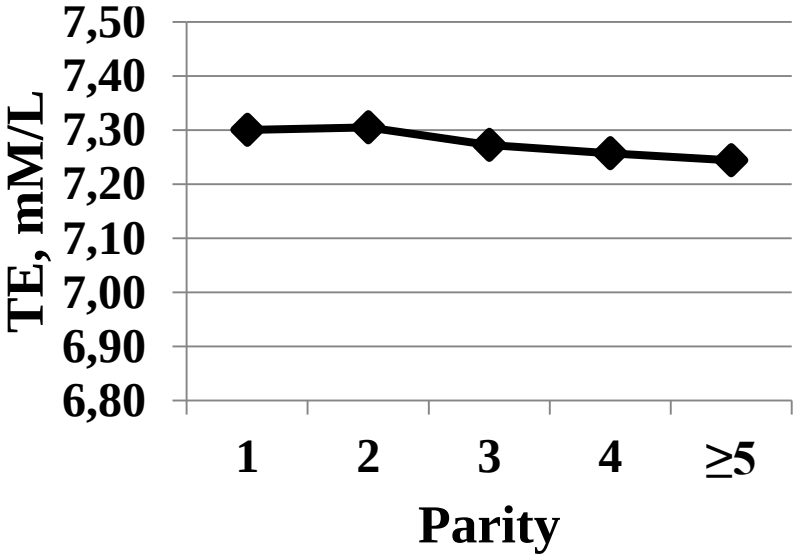
$$y_{ijkl} = \mu + DIMclass_i + parity_j + (DIMclass \times parity)_{ij} + HTD_k + Cow_l$$

Results

Descriptive statistics for calibration and population databases						
		Number	Mean	Standard deviation	Min	Max
TAA	Calibration (measured)	1,690	7.07	0.82	4.16	9.62
	Population (predicted)	83,482	7.29	0.34	5.55	8.34

Variation across lactation and parity





TE = Trolox Equivalent

Results

Correlations between TAA and traditional milk quality traits								
		Milk yield	Lactose	Fat	Protein	Casein	SCS	MUN
TAA	*r* on predictions	-0.18	-0.13	0.32	0.61	0.60	0.12	0.25
	r on residuals	-0.15	-0.20	0.12	0.68	0.63	0.11	0.16

Dilution effect

Lipid-soluble antioxidants

Main antioxidants in milk

Protection

Antioxidant

Conclusions

Total milk antioxidant activity is relevant both for consumers health and milk processing

FT-MIR can estimate total antioxidant activity of milk with medium-low accuracy, but can be useful for studies at population level

Correlations between total antioxidant activity and milk composition confirms the positive relationships between the new trait and protein content

The developed FT-MIR model could be useful for genetic and genomic studies

Aknowldegments

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All our research group