Session 44 – "Milk and meat product quality (Food Quality Symposium)"

BREED, HOUSING AND FEEDING SYSTEMS AFFECT MILK COAGULATION TRAITS AND CHEESE YIELD AND QUALITY

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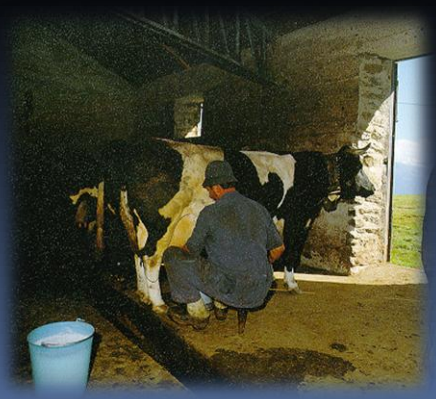
ITALIAN CHEESE MARKET

- Great incidence of cheese-making activities, i.e., about 70% of milk processed to obtain cheese
- 55% of milk used to produce PDO cheese as Grana Padano, Gorgonzola, Asiago, Mozzarella, etc.
- PDO's production are industries:
  - milk from big farms
  - largely diffused breeds
  - intensive systems in plan areas
- Local traditional-homemade cheeses:
  - mountain and marginal areas
  - small farms and local breeds (i.e., Rendena, Alpine Gray, Valdostana, Agerolese, Modicana, etc.)
  - fed traditionally (hay+concentrate) and summer pasture



CHEESE YIELD & QUALITY LINKED TO MILK COMPOSITION

Endogenous factors

- ✓Genetic
  - Species (Abdou et al., 2002; Ismail et al., 2007)
  - Breed (De Marchi et al., 2007; De Marchi et al., 2008)
- ✓Physiology:
  - Health status (SCC)
  - Lactation stage (Sapru et al., 1997; Guinee et al., 2007)
  - Seasonal variations (Barbano & Sherbon, 1984; Gilles and Lawrence, 1985; Paolo et al., 2008).

Exogenous factors

- ✓Feeding (Banks et al., 1985)
- ✓ Environment
- ✓Management

AIM OF THE STUDY

To evaluate milk quality and coagulation traits, yield of cheese and cheese quality in different combination of:

- breed
- housing & feeding

LOCATION OF THE EXPERIMENT

- North east of Italy – Veneto Region in a typical area for cheese production
- 30 dairy farms selected to represent the 2 breeds typically reared in this are: Italian Friesian and the local Rendena

- Farms were selected to represent both traditional and intensive productive systems for housing and feeding:
  - Tied barns & hay + concentrate feeding (Traditional Friesian & Rendena)
  - Tied barns & Maize silage (Intensive Rendena) or total mixed ration (Intensive Friesian-1st level)
  - Free stalls and total mixed ration (Intensive Friesian-2nd level)

FARMS INVOLVED IN THE EXPERIMENT (IN BRACKETS VALUES FOR THE CLUSTERS)

	No. of selected farms	Avg. milk yield kg	Avg. no. milked cows
Friesian			
▪ Traditional	6 (12)	7,764 (7,888)	42 (39)
▪ Intensive level 1	6 (24)	8,698 (8,557)	62 (56)
▪ Intensive level 2	6 (47)	9,670 (9,737)	99 (106)
Rendena			
▪ Traditional	6 (10)	4,523 (4,705)	56 (45)
▪ Intensive	6 (10)	5,161 (5,138)	58 (52)

MATERIAL AND METHODS

- Bulk milk sample (about 10 kg) collected from farms twice, i.e. first sample in late spring and a second in autumn
- Within 1 hr. from collection milk was transported to laboratory to be analysed and processed
- Small wheel cheeses (3 per vat-farm) were obtained following a standard protocol with 11-L cheese vats and processing daily the milk from 4 farms.
- Specific working schedule was adopted to process all 30 seasonal milk bulk sample within one week

STANDARD CHEESE MAKING PROCEDURE

- Warming milk at 32° C for 20 min. with starter bacteria (lactobacillus spp.)
- Addition of rennet
- Cutting of curd for 8 min. & 30 sec at 35 rpm
- Heating of curd at 38°C for 5 min.
- Pressing of curd (3 forms /vat) for 5 hrs. & 20 min. at 3 bar pressure
- Immerging in brine at 20% of NaCl at 10°C for 4 hours
- Ripening for 90 days at 15°C and 85% relative humidity

RECORDED VARIABLES

- Milk composition, pH and titratable acidity (TA; Soxhlet-Henkel degrees)
- Milk coagulation properties (MCP) by computerized renneting meter
- Cheese yield, i.e. percentage of cheese as respect to the amount of milk processed
- Shear force and Color indexes (lightness, L*, red index, a*, and yellow index, b*) on rind and cheese at 90 days of ripening
- Fatty acid composition of cheese after 90 days of ripening by gas chromatography

STATISTICAL ANALYSIS

All variables recorded were analysed with a mιxed linear model for repeated measurements as follows:

$$y_{ijkl}=\mu+T_i+a(T)_{j:i}+P_k+TxP_{ik}+e_{ijkl}$$

Where:

T_i, represent the thesis effect (breed x housing & feeding management, 5 levels);

$a(T)_{j:i}$, is the random effect of farm within T ~N(0, σ^2_a);

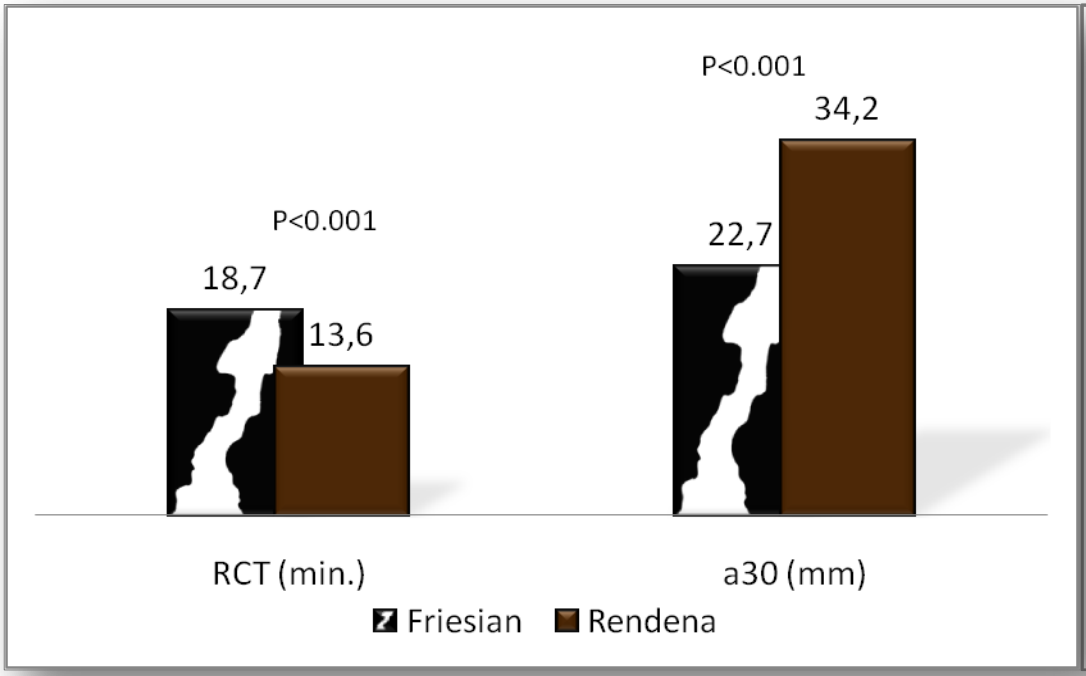
P_k, represent the fixed effect of period (2 levels, late spring and autumn).

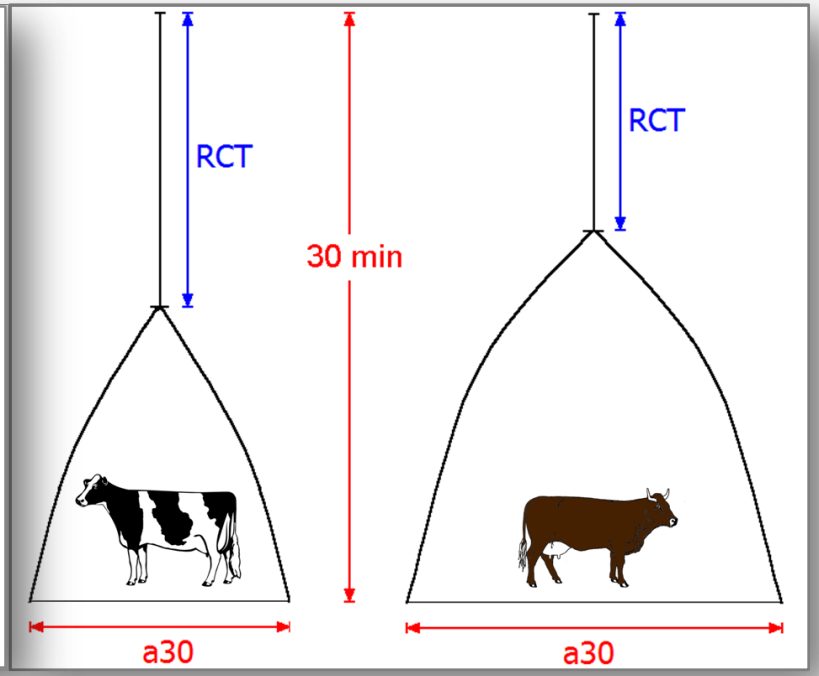
Specific comparison within the T effect were obtained by decomposition of the 5 d.f. aiming at the comparison of breeds traditional vs. intensive systems both across and within breeds.

EFFECTS ON MILK COMPOSITION

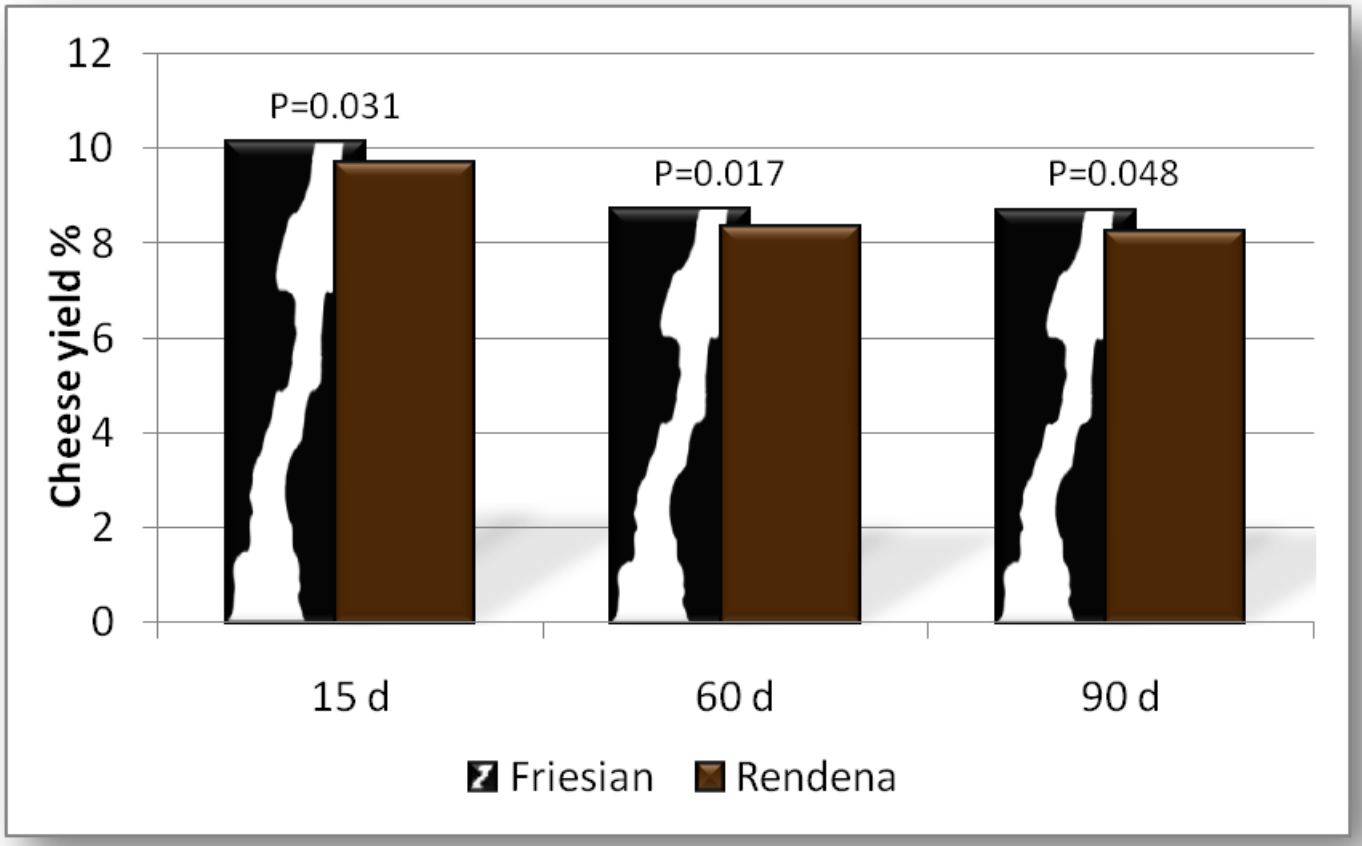
Item	Breed		P	Housing & Feeding		P
	Friesian	Rendena		Traditional	Intensive	
Fat (%)	3.76	3.60	0.030	3.69	3.70	0.869
Protein (%)	3.39	3.27	0.002	3.29	3.37	0.023
Lactose (%)	4.85	4.86	0.371	4.86	4.85	0.827
Casein (%)	2.59	2.52	0.004	2.53	2.58	0.047
SCC (no. x 1,000)	433	274	0.041	333	394	0.418
BC (no. x 1,000)	139	188	0.491	167	153	0.843
pH	6.59	6.55	0.140	6.57	6.58	0.761
TA (°SH/50 ml)	3.23	3.33	0.084	3.25	3.29	0.544

MILK COAGULATION PROPERTIES





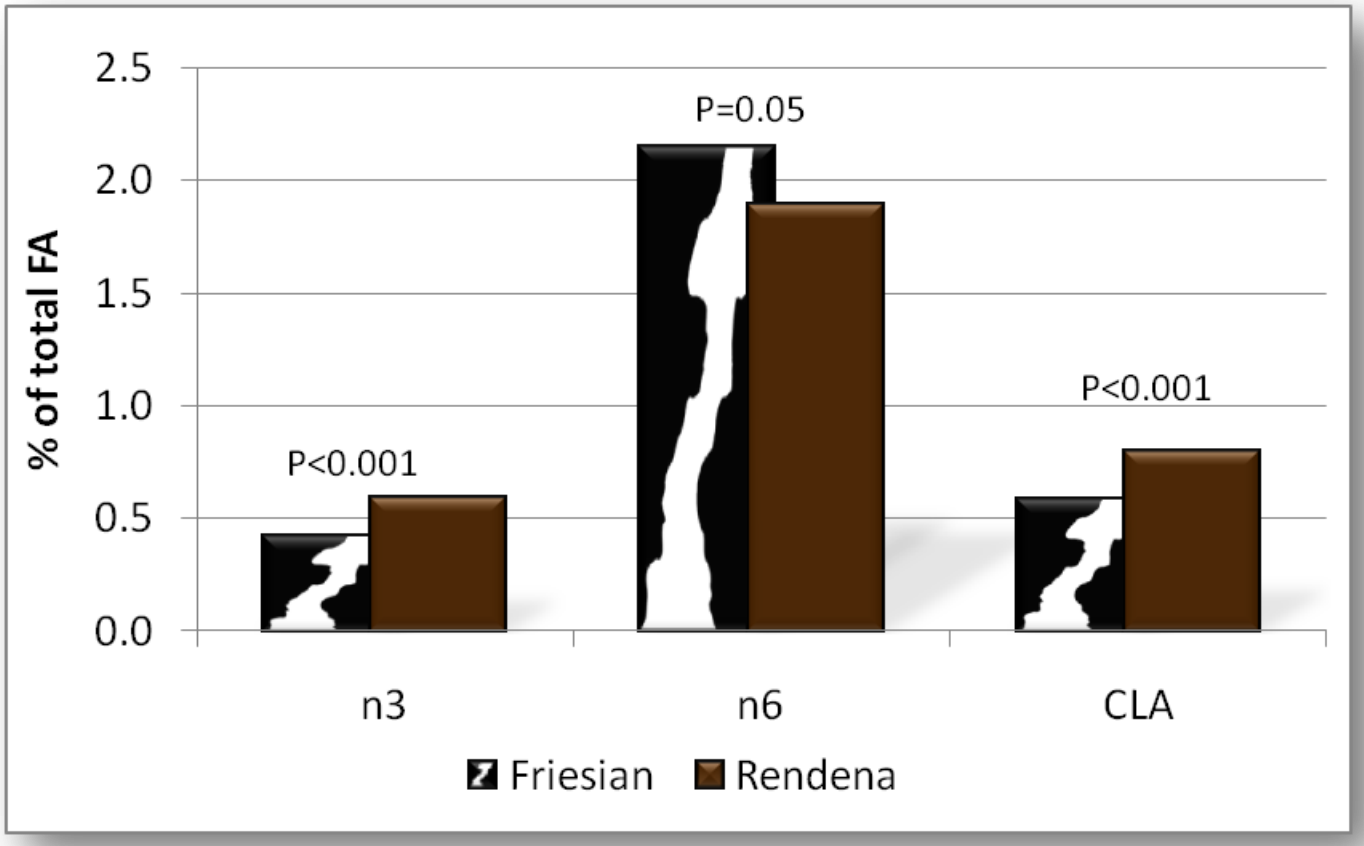
CHEESE YIELD



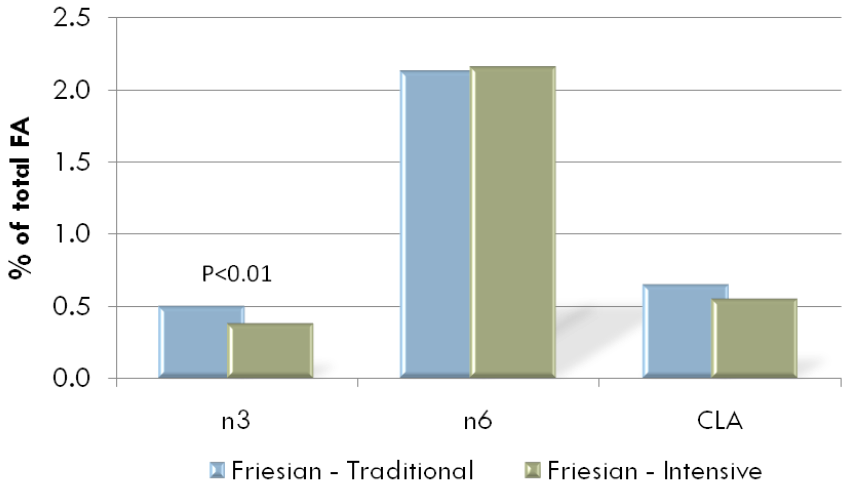
CHEESE AFTER 90 DAYS OF RIPENING

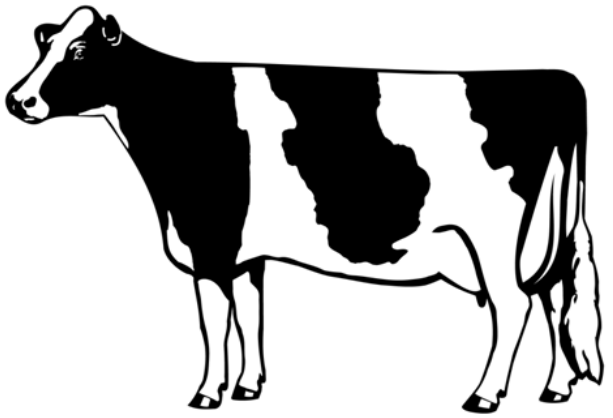
Item	Breed		P	Housing & Feeding		P
	Friesian	Rendena		Traditional	Intensive	
Rind:						
- Shear force, N	26.0	36.1	0.009	33.6	27.6	0.104
- L*	80.3	79.1	0.343	80.3	79.6	0.582
- a*	-1.36	-0.24	<0.001	-0.61	-1.12	0.030
- b*	13.27	17.80	<0.001	16.11	14.40	0.052
- pH	5.3	5.2	0.150	5.3	5.3	0.598
Cheese:						
- Shear force, N	25.4	35.6	0.008	33.3	26.9	0.083
- L*	79.0	77.9	0.451	79.6	77.9	0.299
- a*	-1.48	-0.20	<0.001	-0.60	-1.21	0.010
- b*	12.67	18.21	<0.001	16.40	13.89	0.004
- pH	5.0	5.0	0.100	5.0	5.0	0.256

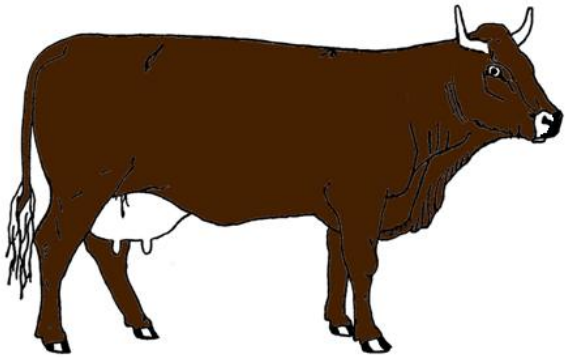
CHEESE QUALITY

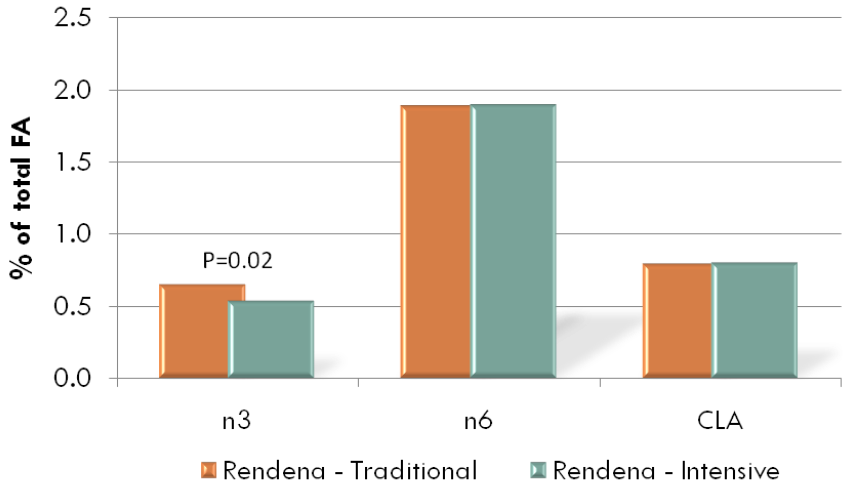


WITHIN BREED QUALITY









CONCLUSION

- The Friesian breed has shown a greater cheese yield due to the greater protein and casein contents
- The local Rendena breed has shown better milk coagulation properties, better aptitude to longer ripening, i.e. to the production of harder cheeses, and better nutritional characteristics, i.e., n3 and CLA content
- However, the traditional system in both breeds has shown a positive effect on the n3 content, confirming that these quality aspects are dependent more from nutrition than from genetics

ACKNOWLEDGMENT

Regione Veneto

THANK YOU FOR YOUR ATTENTION