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UNIVERSITÀ DEGLI STUDI DI TERAMO

Facoltà di Bioscienze e tecnologie agroalimentari e ambientali

ERASMUS + PROJECT : AG-LAB

Training Activities AgLAB

Teramo - 20 October 2021

DEVELOPMENT OF INNOVATIVE STRATEGIES IN THE LIVESTOCK SECTOR TO IMPROVE THE QUALITY AND SUSTAINABILITY OF ANIMAL PRODUCTION

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Topics of the lesson…

- **Sustainability of Livestock Production**
- **Quality of Animal Production**
- **Main results obtained by the Research Unit of Zootechny and Animal Production of the University of Teramo**

Sustainability of Livestock Production

Sustainability as a wicked problem

- It cannot be solved
- It can be only managed

The problem with wicked problems is:

- No definitive formulation of the problem exists
- Its solution is not true or false, but rather better or worse
- Stakeholders have radically different frames of reference concerning the problem
- The underlining cause and effect relationships related to the problem are complex, systemic and either unknown or highly uncertain

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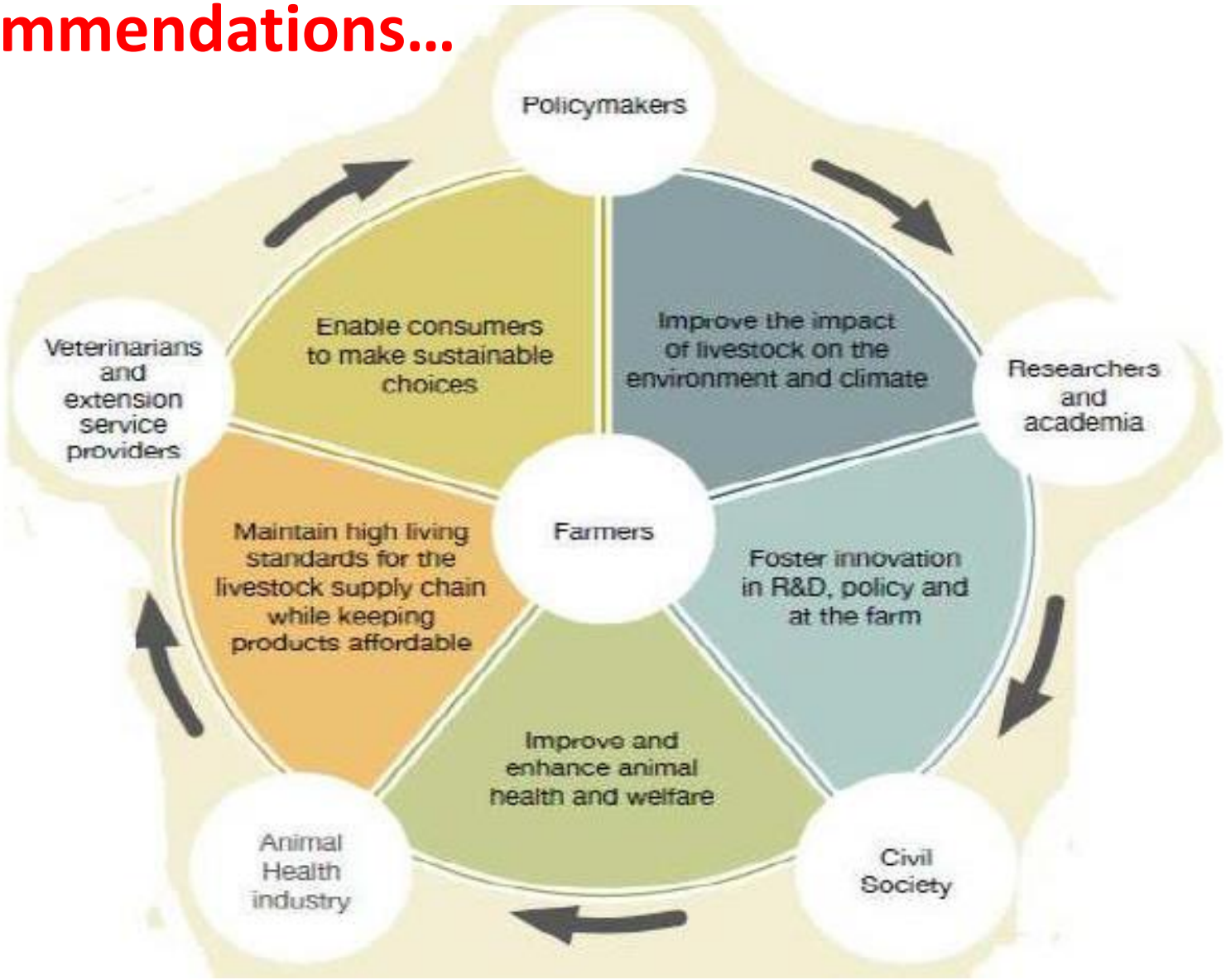
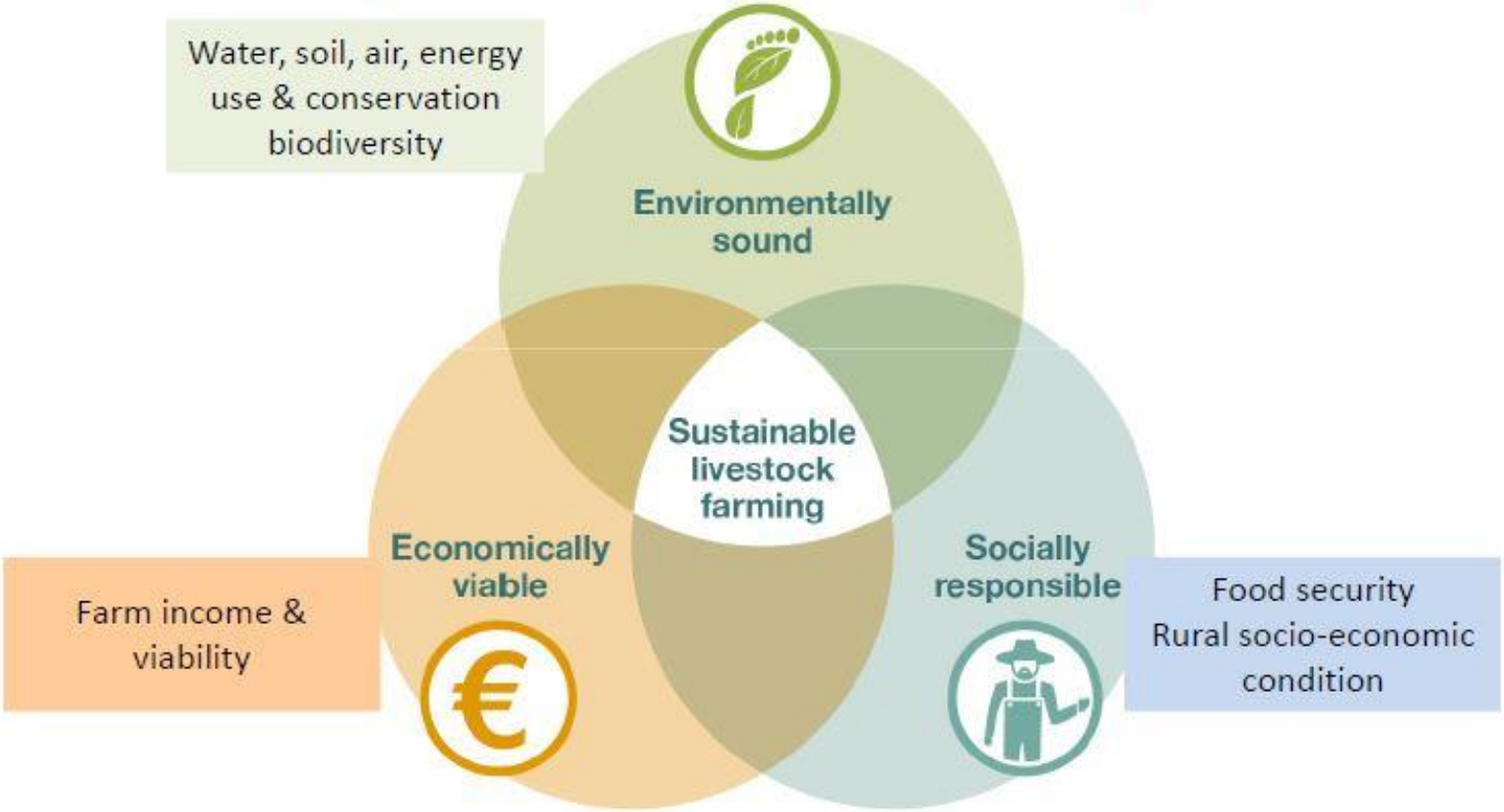
Recommendations…



Sustainable livestock farming refers to a system based on three pillars



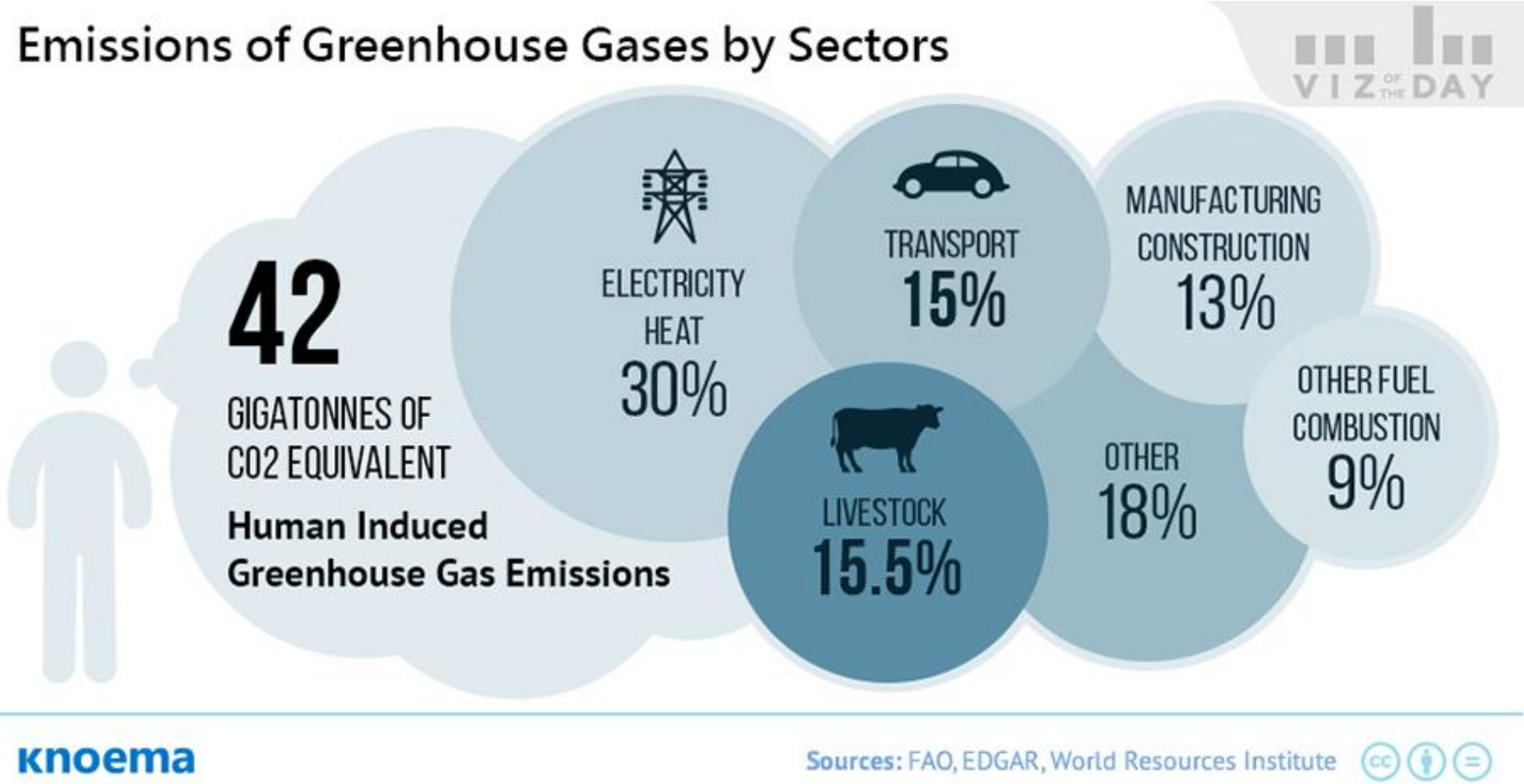
https://www.elancoeurope.com/pdfs/sustainable_livestock_a4_aw_290915_dps.pdf

The most workable definition is…

Something is sustainable if it can simultaneously achieve economic feasibility, social justice and environment quality

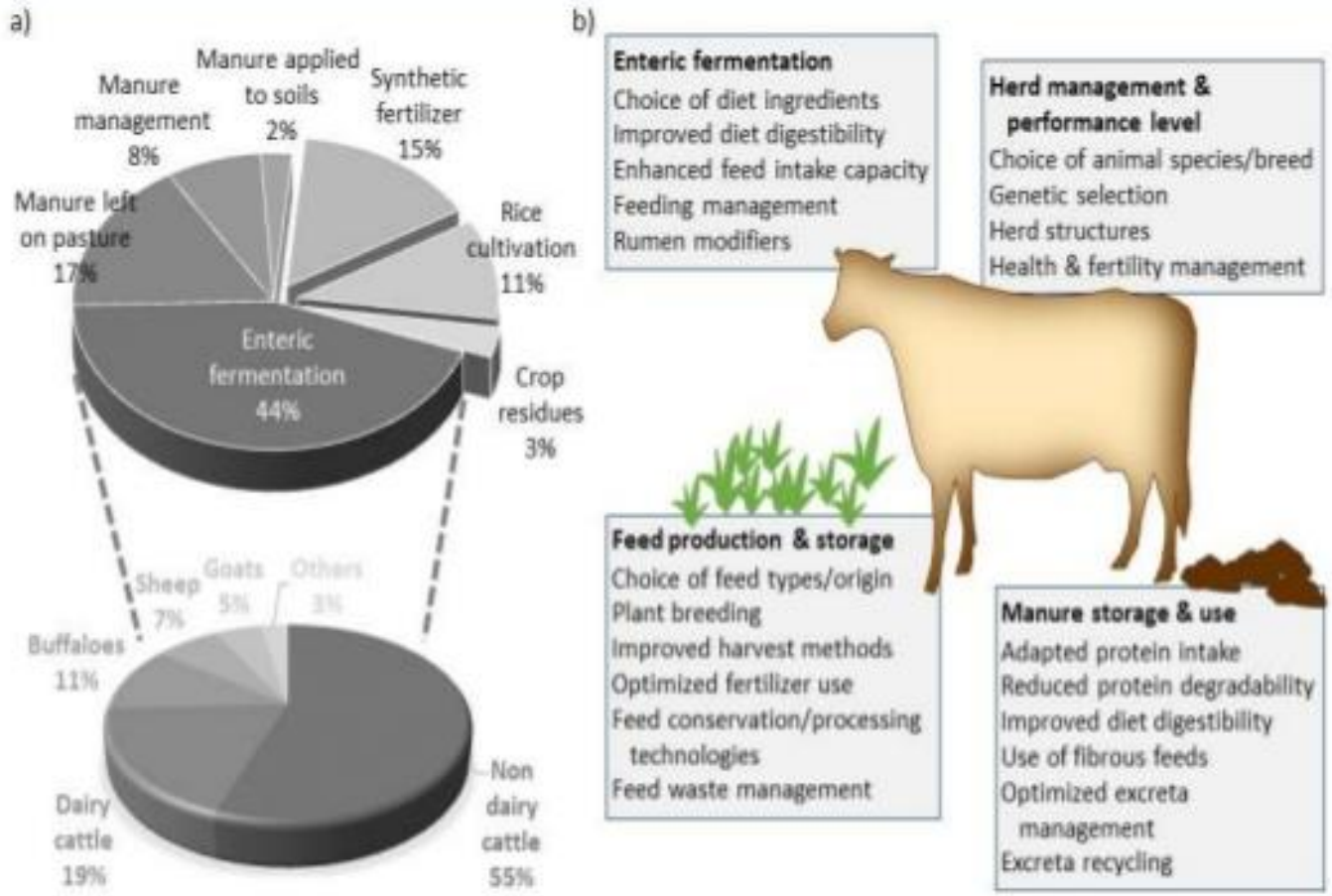
Environmental Impact of Livestock

- ✓ **Release of Green house gas**: livestock is responsible for the 18 % of the total GHG emissions (9% CO_2, 37% CH_4, 65% N_2O)
- ✓ **Water consumption**: 8% of global consumption
- ✓ **Release of residues**: antibiotics, hormones, fertilizers and pesticides.
- ✓ **Biodiversity pauperization**: 306 of 825 ecosystems (WWF) are threatening by livestock productions.


Emissions of Greenhouse Gases by Sectors
VIZ OF THE DAY
42
GIGATONNES OF
CO2 EQUIVALENT
Human Induced
Greenhouse Gas Emissions
ELECTRICITY
HEAT
30%
TRANSPORT
15%
MANUFACTURING
CONSTRUCTION
13%
OTHER FUEL
COMBUSTION
9%
OTHER
18%
LIVESTOCK
15.5%
knoema
Sources: FAO, EDGAR, World Resources Institute

Sources of GHG emissions during livestock production

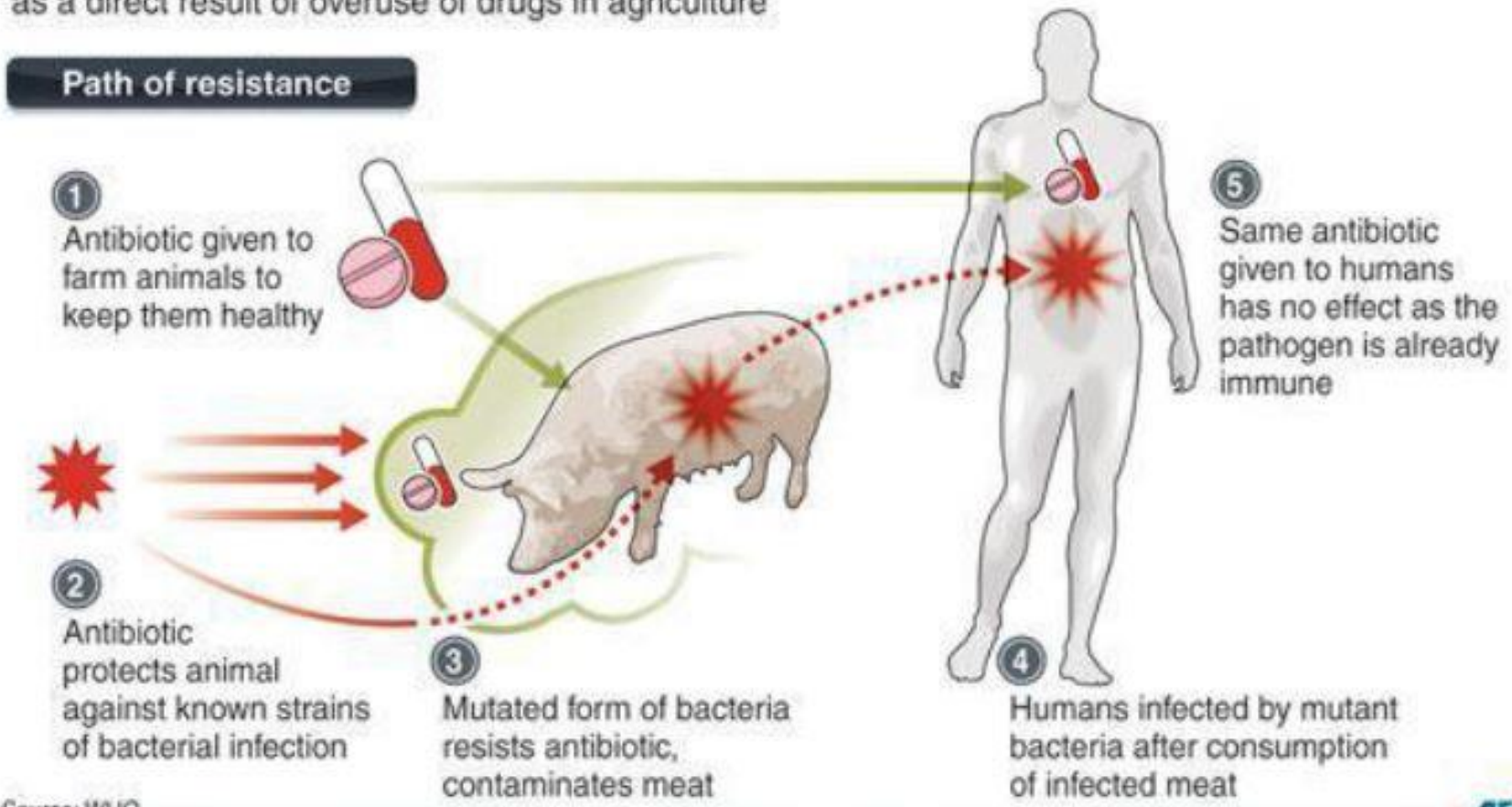
(Dickhoefer et al., 2014)



ILRI CGIAR

Drugs, animals and mutations

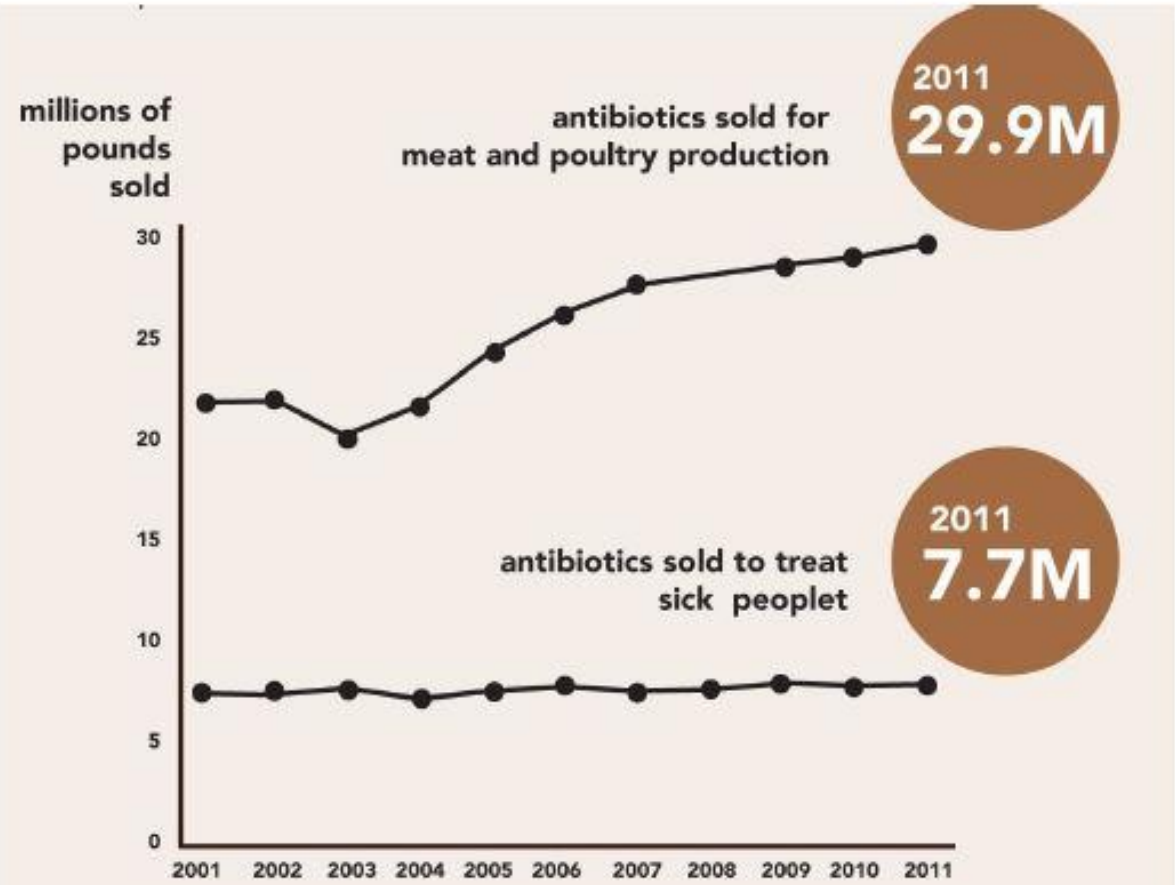
The World Health Organization has detected increased bacterial resistance to antibiotics as a direct result of overuse of drugs in agriculture



Source: WHO

AFP

Drugs use in livestock



Source: Pew Charitable Trusts. 2013. Record-high antibiotic sales for meat and poultry production. Available:

Additives

Phytotherapic: are natural secondary compounds of plants and their use in livestock is increasing. It is reported a positive effects on the production and animal health. Studies have shown that the use of these extracts in the diet of livestock species induces improvements in production performance, feed conversion, antioxidant capacity of plasma, rumen activity and intestinal enzyme activity.

Very important in the organic farming systems!

Additives

Probiotics: are "live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host". (World Health Organization, 2001). The main are: *Lactobacillus acidophilus, Lactobacillus casei, Lactococcus lactis, Enterococcus faecium, Bifidobacterium bifidum, Bifidobacteriumt hermophilum*, and *Saccharomyces cerevisiae*.

They maintain proper composition of intestinal microflora, have a positive effect on immune system increasing the IgA release or macrophage activity.

Probiotics

- They are microorganisms that, when administered in adequate quantities, confer benefits on the hospital's health (WHO).
- Integration with probiotics (*Lactobacillus acidophilus* and *Pediococcus acidilactici*) in the diet of pig resulted in a reduction in E. coli's fecal count and clostrides, pathogens responsible for the onset of diarrhea in this animal species (Dowarah et al., 2017).

Probiotics

- Recently, the interest in probiotics has focused on their ability to influence the specific and nonspecific immune response response.
- Some studies have shown that a treatment with L. casei and L. acidophilus determines an increase in IgA production (Galdeano et Perdigòn, 2006), which improves the intestinal barrier function.
- Moreover, probiotics, through the production of cytokines, have the ability to influence the cellular immune response mediated by t cells in the intestinal epithelium.
- Finally, it has been shown that lactobacilli are able to stimulate macrophage activity towards different species of bacteria.

Quality of Animal Production

Quality of livestock products

Intrinsic determinants

Total Quality:

Intrinsic parameters of quality

Extrinsic parameters of quality

Intrinsic quality:

- Health and hygiene
- Chemical bromatological
- Nutritional
- Organoleptic
- Technological

Extrinsic quality:

- Animal welfare
- Environmental sustainability

Intrinsic quality of animal products

✓Hygienical sanitary
1) Microbial count
2) Residues

✓Chemical
1) Water
2) pH
3) Protein
4) Fat

✓Organoleptic
1) Taste
2) Odour
3) Colour
4) Flavour

✓Nutritional
1) Protein fractions
2) fatty acids
3) Cholesterol
4) Minerals
5) Trace elements
6) Vitamins

✓Technology
1) Processing
2) Yield

Extrinsic quality of animal products

In the last years the concept of quality was also directed to:

- ✓ Animal welfare
- ✓ Environmental sustainability
- ✓ Social aspect

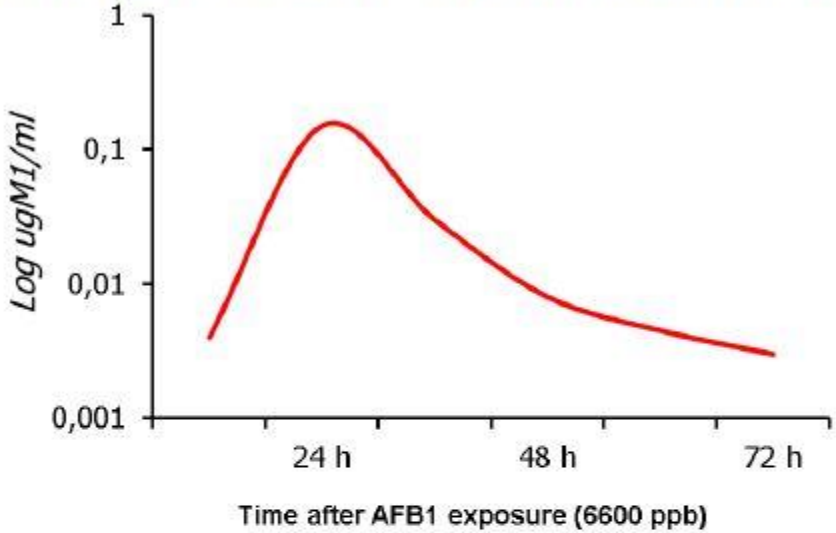
Factors affecting quality of primary livestock products

- ✓ Hygiene
- ✓ Species, breed, genotype
- ✓ Animal nutrition
- ✓ Farm management
- ✓ Health status
- ✓ Climate conditions

AFLATOXIN M_1

- Produced by the metabolism of animals exposed to contaminated food of AFB1
- Oxidation of AFB1 catalyzed by hepatic monooxygenase system and excretion in milk

KINETIC OF AFM1 EXCRETION



Ruth *et all.*,1968

- *The rate of excretion of aflatoxin M1 with respect to aflatoxin B1 assumed (CARRY-OVER) can vary between 0.2% and 5.0%*

Average Carry-over about 3%

AFM_1

Cow's milk, at the time of collection from farm must comply with the following parameters

Parameters	Raw milk for human consumption	Raw milk high quality
Fat	Not given	> 3,5 %
Protein	> 2.8 %	> 32 g/litro
Total bacterial count CFU/ml	< 100.000*	< 100.000*
Somatic cells (n./ml)	< 400.000**	< 300.000**

* Geometric average calculated over 2 months with at least 2 controls for month.
** Geometric average calculated over 3 months with at least 1 control for month.

Feeding factors that may modify fatty acids (CLA) in milk

Factors	Effetc on CLA
Lipids	
unsaturated vs saturated	↑ with UFA
Type of vegetable oil	↑ with oil ↑ C18:2
palm oil	It is dose dependent
fat of animal origin	low effect ($p<0.05$)
corn oil	low effect ($p<0.05$)
soy	↑ if heat treated
Modulators of biohydrogenation	
forage/concentrate ratio	↑ with high rate
feeding restriction	↑
fish oil	↑ ↑ compared to veg. oil
tampons	low effect ($p<0.05$)
Type of forage	
pasture vs. conservated forages	↑ with pasture
age of forage	↑ with juvenile forages

Bauman et al., 2001

FATTY ACIDS PROFILE IN BEEF, PORK AND CHICKEN

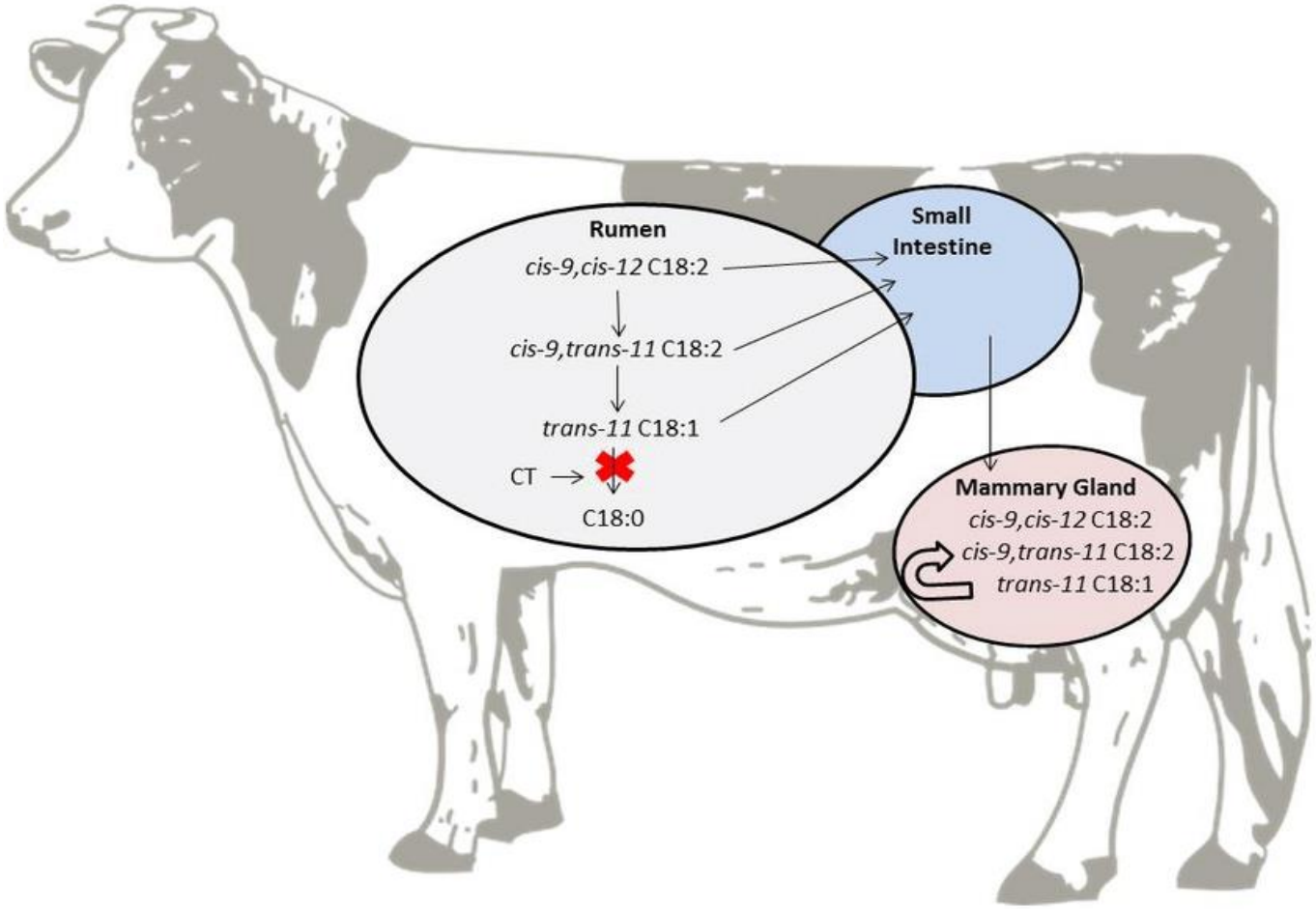
% Fatty acids	Beef	Pork	Chicken
Palmitic acid	24-27%	23-25%	22-24%
Stearic acid	**19-21%**	15-17%	8-11%
SFA	**47-51%**	39-43%	34-37%
Oleic acid	28-30 %	**38-44%**	26-30%
MUFA	33-39%	**47-51%**	28-32%
Linoleic acid	3-4%	5-6%	**19-21%**
Linolenic acid	1-2%	0,5-1%	0.5%
PUFA	8-10%	8-10%	**30-32%**

The intramuscular fatty acid composition of the monogastric animals, and in particular the triacylglycerols are a reflection of the dietary fatty acids (High PUFA in fed High PUFA in meat).
In ruminants the biohydrogenation in the rumen (i.e. saturation of the dietary unsaturated fatty acids) is responsible for the smaller variations in intramuscular fatty acid composition (High PUFA in diet High CLA and SFA in meat).

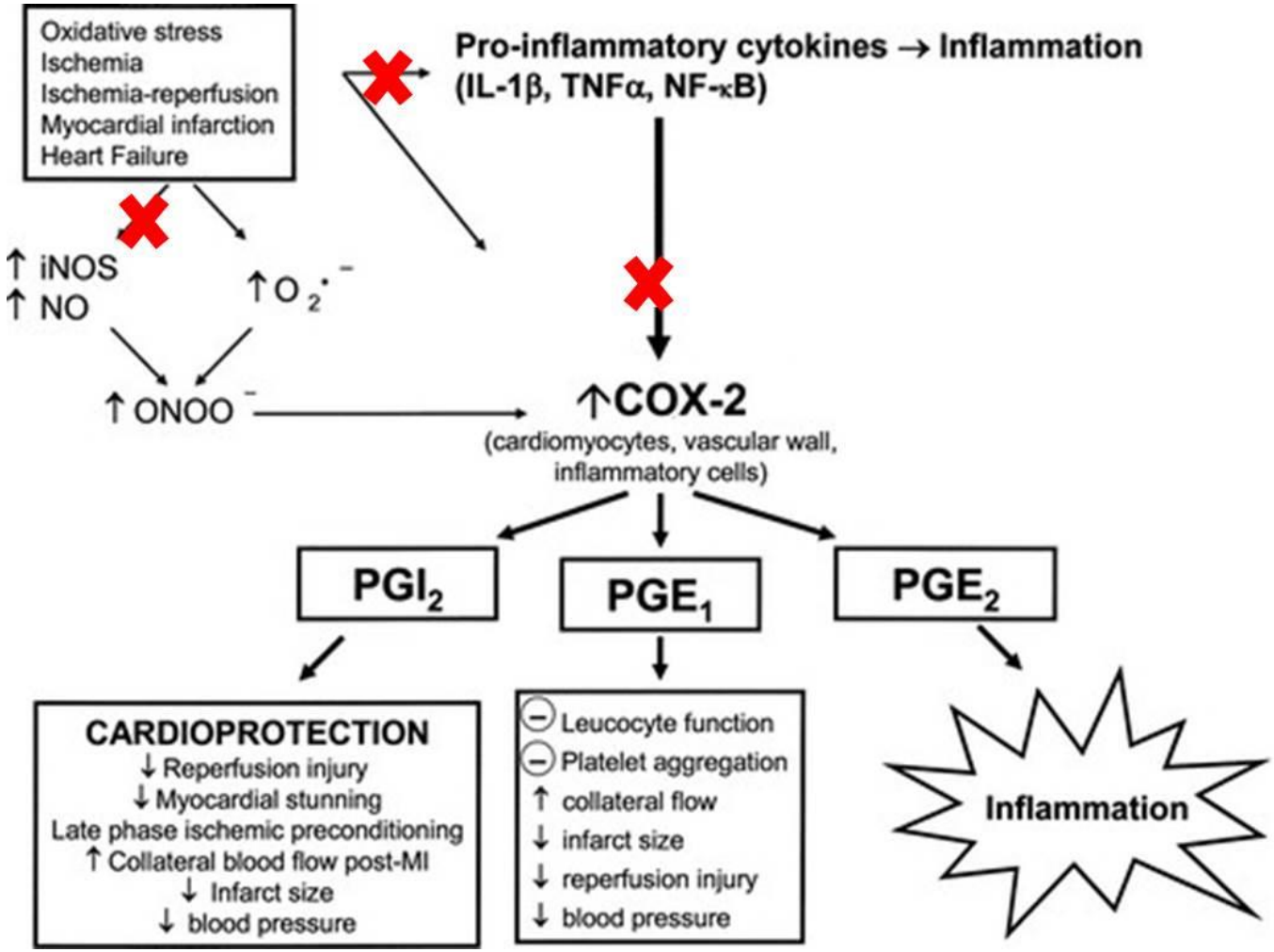
How the ruminal function influences the production quality?

Biohydrogenation

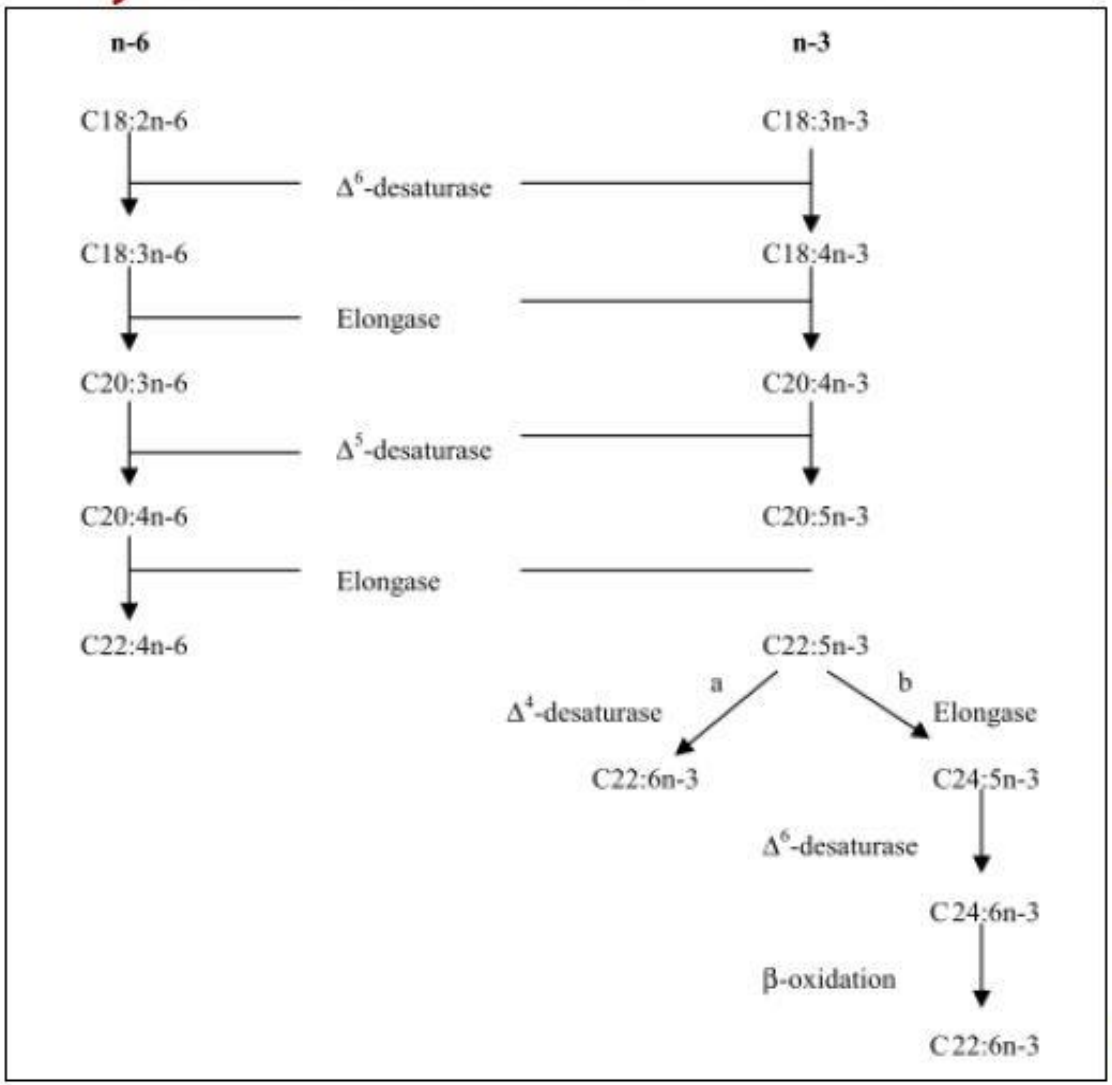
Ruminal Biohydrogenation



Bassaganya-Riera, J., & Hontecillas, R. (2010). Dietary CLA and n-3 PUFA in inflammatory bowel disease. Current opinion in clinical nutrition and metabolic care, 13(5), 569.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2947030/pdf/nihms237437.pdf



CONVERSION OF C18:2n6 (Linoleic) and C18:3n3 (Linolenic)TO THEIR LONGER CHAIN FATTY ACID



EPA

DHA

Main results obtained by the Research Unit of Zootechny and Animal Production of the University of Teramo

Use of agro-industrial by-products in zootechnical nutrition

Use of agro-industrial by-products in zootechnical nutrition

foods

Article

Influence of Grape Pomace Intake on Nutritional Value, Lipid Oxidation and Volatile Profile of Poultry Meat

Francesca Bennato [1,†], Alessio Di Luca [1,†], Camillo Martino [2], Andrea Ianni [1], Elettra Marone [1], Lisa Grotta [1], Solange Ramazzotti [1], Angelo Cichelli [3] and Giuseppe Martino [1,*]

molecules MDPI

Article

Volatile Profile in Yogurt Obtained from Saanen Goats Fed with Olive Leaves

Francesca Bennato [1,†], Denise Innosa [1,†], Andrea Ianni [1], Camillo Martino [2], Lisa Grotta [1] and Giuseppe Martino [1,*]

ORIGINAL PAPER

Influence of olive leaves feeding on chemical-nutritional quality of goat ricotta cheese

Denise Innosa[1] · Francesca Bennato[1] · Andrea Ianni[1] · Camillo Martino[2] · Lisa Grotta[1] · Francesco Pomilio[3] · Giuseppe Martino[1]

Received: 18 October 2019 / Revised: 4 January 2020 / Accepted: 12 January 2020 / Published online: 24 February 2020

Chemical–nutritional quality and oxidative stability of milk and dairy products obtained from Friesian cows fed with a dietary supplementation of dried grape pomace

Andrea Ianni,[a] Gaetano Di Maio,[a] Paola Pittia,[a] Lisa Grotta,[a] Giorgia Perpetuini,[a] Rosanna Tofalo,[a] Angelo Cichelli[b] and Giuseppe Martino[a*]

animals

Article

Dietary Supplementation of Dried Grape Poma Increases the Amount of Linoleic Acid in Beef, Reduces the Lipid Oxidation and Modifies the Volatile Profile

Andrea Ianni [1,2], Alessio Di Luca [1], Camillo Martino [3], Francesca Bennato [1], Elettra Marone [1], Lisa Grotta [1], Angelo Cichelli [2] and Giuseppe Martino [1,*]

J. Dairy Sci. 102:1025–1032
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Short communication: Compositional characteristics and aromatic profile of caciotta cheese obtained from Friesian cows fed with a dietary supplementation of dried grape pomace

A. Ianni,[1] D. Innosa,[1] C. Martino,[2] F. Bennato,[1] and G. Martino[1]*
[1]Faculty of BioScience and Technology for Food, Agriculture and Environment, University of Teramo, (TE), 64100, Italy
[2]Department of Veterinary Medicine, University of Perugia, via S. Costanzo, 4-06126 Perugia, (PG), Italy

Increase in concentration of PUFAs in milk and cheeses and better shelf-life of ripened products

Dietary supplement with Olive Pomace

Table 6. Aggregated fatty acids and healthy indices observed in individual milk at the end of trial and after 30 days of ripening in the relative produced cheese

	Groups[1]							
	Milk				*Cheese*			
Item[2]	C	E	SEM	P	C	E	SEM	P
SFA	74.03	71.04	0.59	***	72.73	69.58	0.65	***
MUFA	20.46	23.36	0.52	***	21.07	24.18	0.53	***
PUFA	2.93	3.09	0.07	0.15	2.88	3.30	0.15	0.08
CLA	0.61	0.79	0.02	***	0.76	0.97	0.03	***
SFA/UFA	3.20	2.70	0.08	**	3.06	2.53	0.11	**
Atherogenic index	4.36	3.62	0.11	***	4.12	3.42	0.16	**
Thrombogenic index	4.74	4.07	0.13	**	4.56	3.84	0.11	***
DI[3]	10.66	10.19	0.66	0.63	9.57	9.77	0.32	0.66

[1]C = control diet; E = experimental diet supplemented with 2 kg on DM of dried olive pomace during 60 days
[2]expressed as percentage
[3]Desaturation index (cis-9 14:1/14:0 + cis-9 14:1)
*P<0.05; **P<0.01; *** P<0.001

Castellani et al., 2017

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Short communication: Compositional characteristics and aromatic profile of caciotta cheese obtained from Friesian cows fed with a dietary supplementation of dried grape pomace

	Bulk milk		
Item	GP−	GP+	*P*-value
C4:0	2.59 ± 0.38	2.49 ± 0.35	NS
C6:0	2.02 ± 0.24	2.00 ± 0.19	NS
C8:0	1.39 ± 0.21	1.35 ± 0.06	NS
C10:0	3.41 ± 0.37	3.39 ± 0.26	NS
C12:0	4.15 ± 0.39	4.17 ± 0.37	NS
C14:0	12.52 ± 1.39	12.71 ± 1.23	NS
C14:1	1.08 ± 0.08	1.13 ± 0.10	NS
C15:0	1.06 ± 0.11	1.17 ± 0.12	NS
C16:0	34.15 ± 3.85	33.31 ± 3.90	NS
C16:1	1.01 ± 0.08	1.13 ± 0.17	NS
C18:0	10.73 ± 0.58	10.81 ± 0.48	NS
C18:1 *trans*	0.64 ± 0.08	0.98 ± 0.11	**
C18:1 cis-9	17.20 ± 1.95	17.26 ± 2.18	NS
C18:1 *trans*-11	0.43 ± 0.04	0.40 ± 0.06	NS
C18:2	2.28 ± 0.23	2.60 ± 0.31	**
C18:3	0.46 ± 0.06	0.47 ± 0.07	NS
Rumenic acid	0.44 ± 0.03	0.38 ± 0.06	NS
Other	3.88 ± 0.32	4.33 ± 0.41	*

*$P < 0.05$; **$P < 0.01$.

Grape pomace is rich in linoleic acid (C18:2)

Ianni et al. (2019)

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AJAS
Asian-Australasian Journal of Animal Sciences

Chemical-nutritional characteristics and aromatic profile of milk and related dairy products obtained from goats fed with extruded linseed

Francesca Bennato[1], Andrea Ianni[1], Denise Innosa[1], Lisa Grotta[1], Andrea D'Onofrio[1], and Giuseppe Martino[1,*]

Linseed is rich in linolenic acid (C18:3)

Items	Bulk milk		
	CG	EL+	p-value
C4:0	2.61 ± 0.48	3.01 ± 0.19	*
C6:0	3.24 ± 0.57	4.09 ± 0.32	*
C8:0	4.11 ± 0.16	4.72 ± 0.36	*
C10:0	14.73 ± 2.55	13.18 ± 1.02	ns
C12:0	9.19 ± 1.03	8.63 ± 0.66	ns
C14:0	15.75 ± 1.29	15.04 ± 1.03	ns
C15:0	1.08 ± 0.09	1.01 ± 0.08	ns
C16:0	27.27 ± 2.38	27.00 ± 1.71	ns
C17:0	0.62 ± 0.04	0.46 ± 0.03	ns
C18:0	3.42 ± 0.12	3.80 ± 0.19	*
SFA	**82.02 ± 0.93**	**80.94 ± 0.56**	ns
C14:1 c9	0.22 ± 0.02	0.15 ± 0.02	ns
C16:1 c9	0.65 ± 0.05	0.42 ± 0.04	ns
C18:1 t11	0.50 ± 0.04	0.67 ± 0.05	*
C18:1 c9	13.30 ± 0.14	13.60 ± 0.12	*
C18:1 c11	0.25 ± 0.02	0.31 ± 0.03	*
MUFA	**14.92 ± 0.95**	**15.15 ± 1.05**	ns
C18:2 c9,12	1.63 ± 0.51	1.09 ± 0.08	*
C18:2 c9, t11	0.38 ± 0.03	0.50 ± 0.04	*
C18:3 c9,12,15	1.05 ± 0.54	2.32 ± 0.16	*
PUFA	**3.06 ± 0.21**	**3.91 ± 0.32**	*
SCFA[1)]	5.85 ± 0.53	7.10 ± 0.26	**
MCFA[2)]	45.08 ± 1.96	42.73 ± 1.53	ns
LCFA[3)]	49.07 ± 1.42	50.17 ± 1.27	ns

animals

MDPI

Article

Physical, Nutritional, and Sensory Properties of Cheese Obtained from Goats Fed a Dietary Supplementation with Olive Leaves

Denise Innosa [1], Andrea Ianni [1], Michele Faccia [2], Camillo Martino [3], Lisa Grotta [1], Maria Antonietta Saletti [3], Francesco Pomilio [3] and Giuseppe Martino [1,*]

Olive Leaves are rich in linolenic acid (C18:3)

	Milk		
Fatty Acids [1]	CG	EG	*p*-Value
C4:0	1.50 ± 0.53	1.39 ± 0.55	ns
C6:0	1.99 ± 0.58	1.92 ± 0.58	ns
C8:0	2.65 ± 0.69	2.64 ± 0.72	ns
C10:0	10.14 ± 1.81	9.87 ± 2.30	ns
C12:0	4.92 ± 0.89	4.52 ± 0.86	ns
C14:0	11.99 ± 0.8	11.49 ± 1.14	ns
C15:0	0.97 ± 0.10	0.96 ± 0.11	ns
C16:0	28.14 ± 0.57	27.30 ± 0.35	*
C17:0	0.61 ± 0.09	0.63 ± 0.08	ns
C18:0	9.17 ± 0.49	10.34 ± 0.65	*
C20:0	0.22 ± 0.04	0.26 ± 0.05	ns
C22:0	0.07 ± 0.02	0.09 ± 0.02	ns
SFA	72.35 ± 2.81	71.41 ± 3.42	ns
C14:1 *cis*-9	0.44 ± 0.08	0.46 ± 0.08	ns
C16:1 *cis*-9	0.31 ± 0.05	0.34 ± 0.05	ns
C18:1 *trans*-11	0.38 ± 0.03	0.44 ± 0.02	*
C18:1 *cis*-9	18.62 ± 0.22	19.57 ± 0.34	**
C18:1 *cis*-11	0.31 ± 0.06	0.31 ± 0.10	ns
MUFA	20.05 ± 1.91	21.12 ± 2.04	ns
C18:2 *cis*-9, *cis*-12	2.68 ± 0.39	2.43 ± 0.59	ns
CLA	0.81 ± 0.54	0.98 ± 0.64	ns
C18:3 *cis*-9, *cis*-12, *cis*-15	0.75 ± 0.03	0.85 ± 0.05	*
PUFA	4.25 ± 0.64	4.26 ± 0.65	ns
Others	3.34 ± 0.44	3.21 ± 0.27	ns

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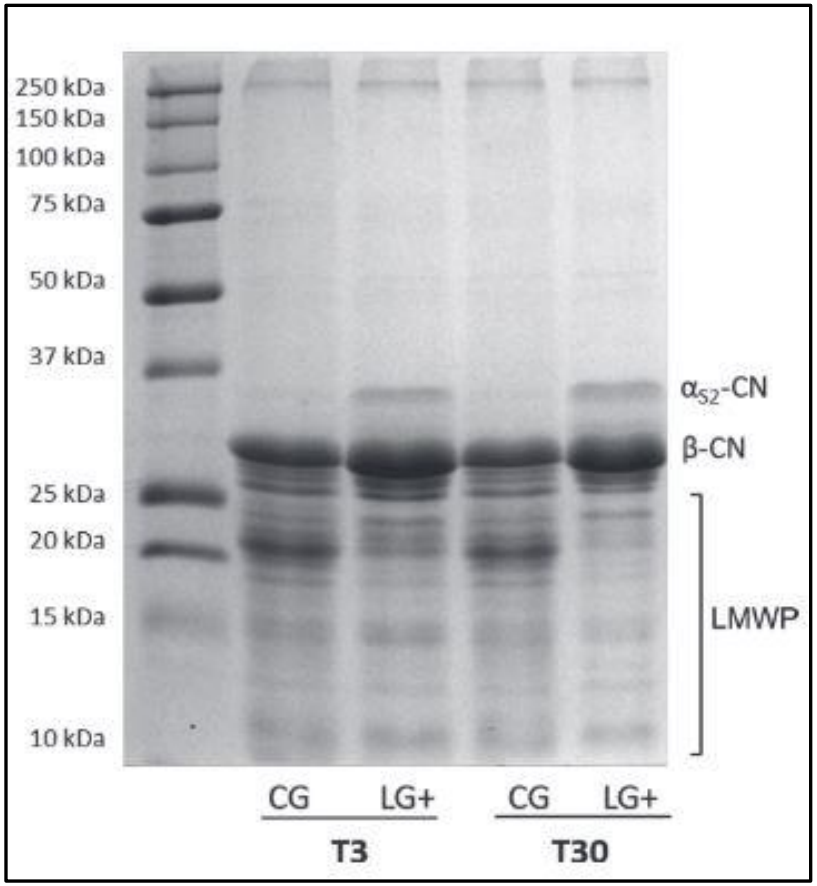
Dietary supplementation of Saanen goats with dried licorice root modifies chemical and textural properties of dairy products

Francesca Bennato,[1] Andrea Ianni,[2] Camillo Martino,[3] Alessio Di Luca,[1] Denise Innosa,[1] Armando Marco Fusco,[1] Francesco Pomilio,[4] and Giuseppe Martino[1*]



Licorice root feeding also improved the cheese oxidative stability during ripening

animals

MDPI

Article

Dietary Supplementation of Dried Grape Pomace Increases the Amount of Linoleic Acid in Beef, Reduces the Lipid Oxidation and Modifies the Volatile Profile

Andrea Ianni [1,2], Alessio Di Luca [1], Camillo Martino [3], Francesca Bennato [1], Elettra Marone [1], Lisa Grotta [1], Angelo Cichelli [2] and Giuseppe Martino [1,*]

Fatty Acids †	CG	EG	p
C14:0	2.37 ± 0.68	2.68 ± 0.62	ns
C15:0	0.39 ± 0.06	0.42 ± 0.06	ns
C16:0	26.56 ± 2.59	27.53 ± 1.55	ns
C17:0	1.24 ± 0.20	1.02 ± 0.31	ns
C18:0	18.64 ± 0.27	16.33 ± 0.20	ns
C22:0	1.79 ± 0.57	1.75 ± 0.88	ns
SFA	50.99 ± 3.07	49.74 ± 2.06	ns
C14:1	0.31 ± 0.15	0.33 ± 0.13	ns
C16:1	1.98 ± 0.62	1.82 ± 0.49	ns
C18:1 *cis*-9	25.79 ± 1.35	26.20 ± 1.48	ns
C18:1 *trans*-11	1.74 ± 0.35	1.55 ± 0.29	ns
C18:1 *trans* ‡	6.64 ± 3.28	4.13 ± 2.74	ns
MUFA	36.45 ± 2.78	33.96 ± 3.25	ns
C18:2 *cis*-9 *cis*-12	8.76 ± 1.47	13.03 ± 1.98	*
C18:3 *cis*-9 *cis*-12 *cis*-15	0.39 ± 0.11	0.43 ± 0.24	ns
PUFA	10.94 ± 1.42	15.21 ± 3.01	ns

VOC †	CG	EG	p
pentanal	1.91 ± 0.24	1.99 ± 0.23	ns
hexanal	56.24 ± 3.31	45.95 ± 4.05	*
heptanal	2.84 ± 0.38	2.97 ± 0.34	ns
octanal	2.82 ± 0.42	2.54 ± 0.36	ns
nonanal	6.55 ± 0.57	7.61 ± 0.82	ns
2-octenal	0.33 ± 0.05	0.28 ± 0.04	ns
2-heptanone	0.30 ± 0.04	0.44 ± 0.05	ns
2,3-octanedione	8.98 ± 0.91	13.20 ± 1.67	*
1-pentanol	0.96 ± 0.05	1.36 ± 0.16	ns
1-octen-3-ol	11.43 ± 1.04	15.03 ± 1.79	ns
2-octen-1-ol	2.29 ± 0.24	2.59 ± 0.17	ns
ethylbenzene	0.38 ± 0.05	0.31 ± 0.04	ns
β-Terpinyl acetate	2.48 ± 0.34	3.23 ± 0.35	ns
benzaldehyde	1.84 ± 0.19	1.92 ± 0.19	ns
furan, 2-pentyl	0.65 ± 0.08	0.58 ± 0.06	ns

† Data are reported as mean percentage of (VOCs) ± S.D. * $p < 0.05$; ns: not significant.

foods

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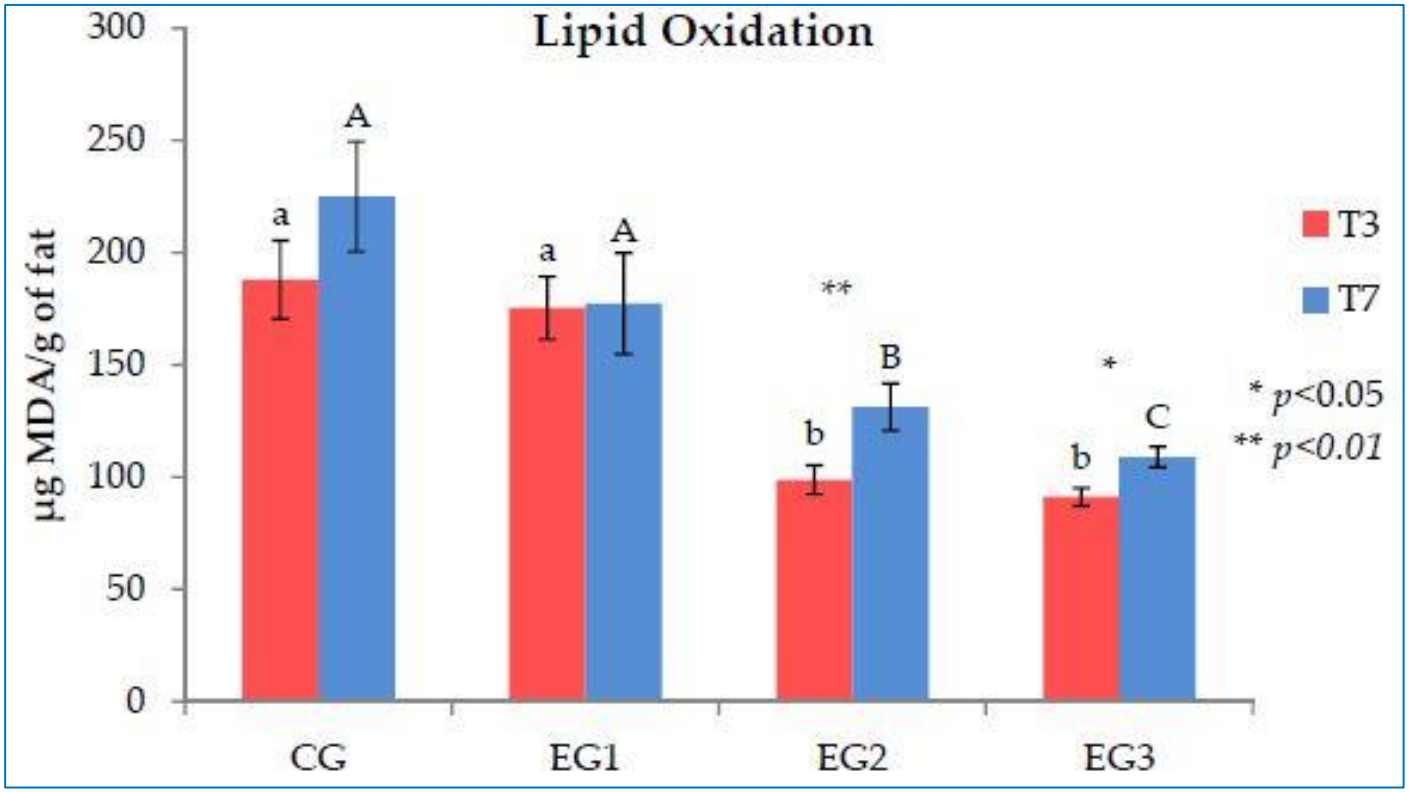
Article

Influence of Grape Pomace Intake on Nutritional Value, Lipid Oxidation and Volatile Profile of Poultry Meat

Francesca Bennato [1,†], Alessio Di Luca [1,†], Camillo Martino [2], Andrea Ianni [1], Elettra Marone [1], Lisa Grotta [1], Solange Ramazzotti [1], Angelo Cichelli [3] and Giuseppe Martino [1,*]

Experimental poultry meat showed richer in linoleic acid (C18:2)



Use of agro-industrial by-products in zootechnical nutrition

SCIENTIFIC REPORTS
natureresearch

Whole blood transcriptome analysis in ewes fed with hemp seed supplemented diet

Marco Iannaccone[1,4], Andrea Ianni[1,4], Felice Contaldi[2], Salvatore Esposito[2], Camillo Martino[3], Francesca Bennato[1], Elisabetta De Angelis[1], Lisa Grotta[1], Francesco Pomilio[3], Daniele Giansante[3] & Giuseppe Martino[1*]

animals
MDPI

Article

Whole Blood Transcriptome Analysis Reveals Positive Effects of Dried Olive Pomace-Supplemented Diet on Inflammation and Cholesterol in Laying Hens

Marco Iannaccone [1,†], Andrea Ianni [1,†], Solange Ramazzotti [1], Lisa Grotta [1], Elettra Marone [1], Angelo Cichelli [2] and Giuseppe Martino [1,*]

animals
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Article

Nutrigenomic Effects of Long-Term Grape Pomace Supplementation in Dairy Cows

Marianna Pauletto [1,†], Ramy Elgendy [1,2,†], Andrea Ianni [3], Elettra Marone [3], Mery Giantin [1], Lisa Grotta [3], Solange Ramazzotti [3], Francesca Bennato [3], Mauro Dacasto [1,*] and Giuseppe Martino [3]

animals

Article

Whole Blood Transcriptome Profiling Reveals Positive Effects of Olive Leaves-Supplemented Diet on Cholesterol in Goats

Andrea Ianni [1], Francesca Bennato [1], Camillo Martino [2], Martina Colapietro [1] and Giuseppe Martino [1,*]

General improvement of the animal welfare

animals

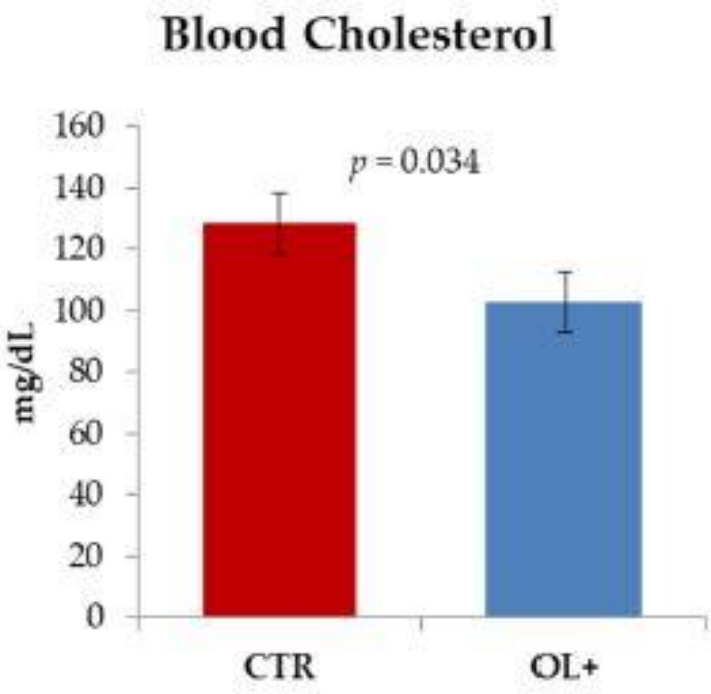
MDPI

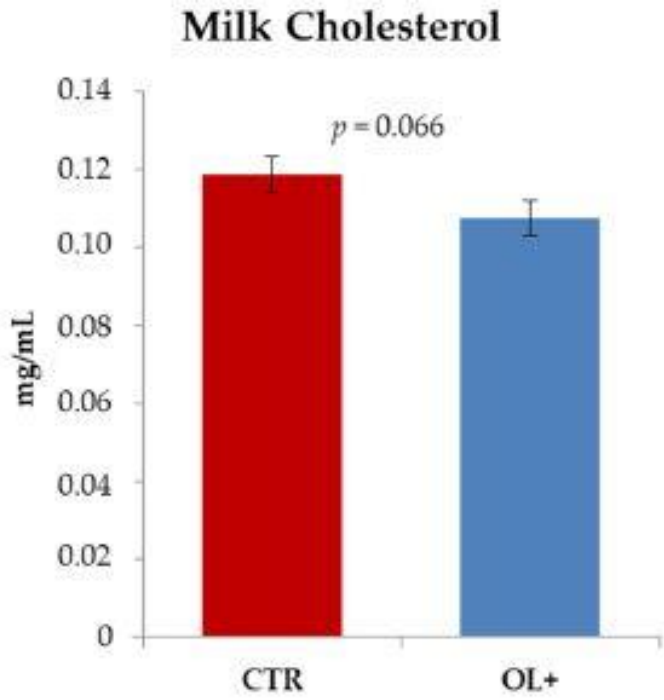
Article

Whole Blood Transcriptome Profiling Reveals Positive Effects of Olive Leaves-Supplemented Diet on Cholesterol in Goats

Andrea Ianni [1], Francesca Bennato [1], Camillo Martino [2], Martina Colapietro [1] and Giuseppe Martino [1,*]

Apolipoprotein B mRNA editing enzyme catalytic subunit 2 (APOBEC2) showed downregulated in goats that received the dietary supplementation





animals

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Article

Nutrigenomic Effects of Long-Term Grape Pomace Supplementation in Dairy Cows

Marianna Pauletto [1,†], Ramy Elgendy [1,2,†], Andrea Ianni [3], Elettra Marone [3], Mery Giantin [1], Lisa Grotta [3], Solange Ramazzotti [3], Francesca Bennato [3], Mauro Dacasto [1,*] and Giuseppe Martino [3]

The gene set enrichment analysis evidenced the positive enrichment of IFN-α and IFN-γ response', IL6-JAK-STAT3 signaling and genes of the complement system

Grape pomace induced an immunomodulatory effect

animals

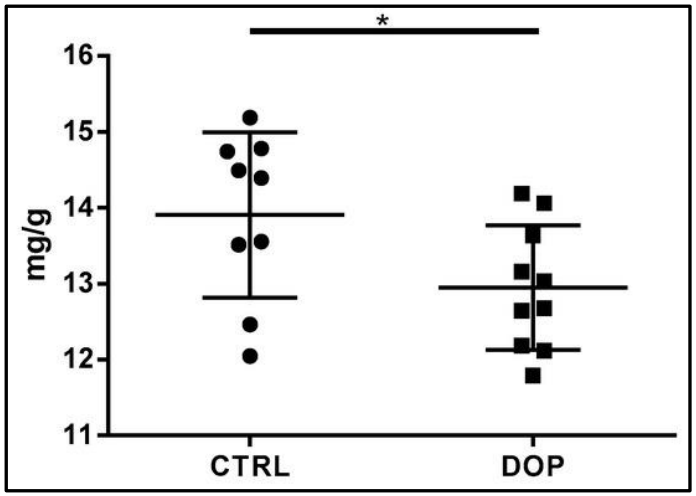
MDPI

Article

Whole Blood Transcriptome Analysis Reveals Positive Effects of Dried Olive Pomace-Supplemented Diet on Inflammation and Cholesterol in Laying Hens

Marco Iannaccone [1,†], Andrea Ianni [1,†], Solange Ramazzotti [1], Lisa Grotta [1], Elettra Marone [1], Angelo Cichelli [2] and Giuseppe Martino [1,*]

Olive pomace improved laying hens health status by influencing cholesterol biosynthesis and immune response (interferon-gamma signaling pathway, interleukin signaling pathway, and JAK/STAT signaling pathway)



Significant decrease in egg yolk cholesterol!

Enrichment of dairy ruminants diet with trace elements

Zinc → Element with antioxidant activity, essential for the function of enzymes, growth factors and gene expression mediators

Selenium → Element with antioxidant activity essential, above all, for the function of enzymes of the antioxidant response

Iodine → High metabolic value as an essential component of thyroid hormones

Enrichment of milk and dairy products with the above mentioned microelements

J. Dairy Sci. 102:2918–2927
https://doi.org/10.3168/jds.2018-15868
© American Dairy Science Association®, 2019.

Zinc supplementation of Friesian cows: Effect on chemical-nutritional composition and aromatic profile of dairy products

Andrea Ianni,[1] Denise Innosa,[1] Camillo Martino,[2] Lisa Grotta,[1] Francesca Bennato,[1] and Giuseppe Martino[1]*
[1]Faculty of BioScience and Technology for Food, Agriculture and Environment, University of Teramo, Via Renato Balzarini 1, 64100 Teramo, Italy
[2]Department of Veterinary Medicine, University of Perugia, Via S. Costanzo 4, 06126 Perugia, Italy

Table 4. Acidic profile of bulk milk and related cheeses obtained from the control group (CG) and zinc group (ZG)[1]

	Bulk milk			Cheese		
Item	CG	ZG	*P*-value	CG	ZG	*P*-value
C4:0	2.25 ± 0.24	2.72 ± 0.26	NS	2.33 ± 0.26	1.98 ± 0.22	NS
C6:0	2.01 ± 0.21	2.36 ± 0.25	NS	1.83 ± 0.19	1.67 ± 0.18	NS
C8:0	1.33 ± 0.15	1.71 ± 0.19	NS	1.57 ± 0.17	1.36 ± 0.15	NS
C10:0	2.09 ± 0.22	2.02 ± 0.23	NS	2.52 ± 0.22	2.83 ± 0.26	NS
C12:0	3.96 ± 0.38	3.56 ± 0.32	NS	3.71 ± 0.31	3.98 ± 0.37	NS
C14:0	13.21 ± 1.23	11.88 ± 1.37	NS	12.77 ± 1.06	11.97 ± 1.21	NS
C14:1	1.44 ± 0.15	1.98 ± 0.21	NS	1.62 ± 0.17	2.05 ± 0.19	NS
C15:0	1.31 ± 0.15	1.66 ± 0.17	NS	1.59 ± 0.15	1.48 ± 0.15	NS
C16:0	39.66 ± 3.35	34.40 ± 3.04	NS	40.37 ± 3.67	36.16 ± 3.21	NS
C16:1	1.87 ± 0.19	2.22 ± 0.21	NS	1.79 ± 0.16	1.91 ± 0.18	NS
C17:0	0.52 ± 0.07	0.68 ± 0.08	NS	0.63 ± 0.08	0.77 ± 0.08	NS
C18:0	7.32 ± 0.69	6.48 ± 0.61	NS	8.61 ± 0.71	8.22 ± 0.63	NS
C18:1 *trans*-11	0.46 ± 0.05	0.82 ± 0.09	**	0.37 ± 0.05	0.69 ± 0.08	*
C18:1 *cis*-9	19.55 ± 1.42	22.95 ± 1.69	*	16.89 ± 1.52	20.93 ± 1.71	*
C18:1 *cis*-11	0.38 ± 0.05	0.51 ± 0.05	NS	0.42 ± 0.05	0.55 ± 0.06	NS
C18:2	1.75 ± 0.16	2.91 ± 0.26	*	2.01 ± 0.18	2.17 ± 0.19	NS
C18:3	0.48 ± 0.06	0.57 ± 0.07	NS	0.56 ± 0.07	0.66 ± 0.07	NS
CLA	0.26 ± 0.03	0.54 ± 0.06	**	0.29 ± 0.03	0.46 ± 0.06	*
C20:4	0.15 ± 0.02	0.23 ± 0.03	NS	0.12 ± 0.02	0.16 ± 0.03	NS

J. Dairy Sci. 102:6853–6862
https://doi.org/10.3168/jds.2019-16382
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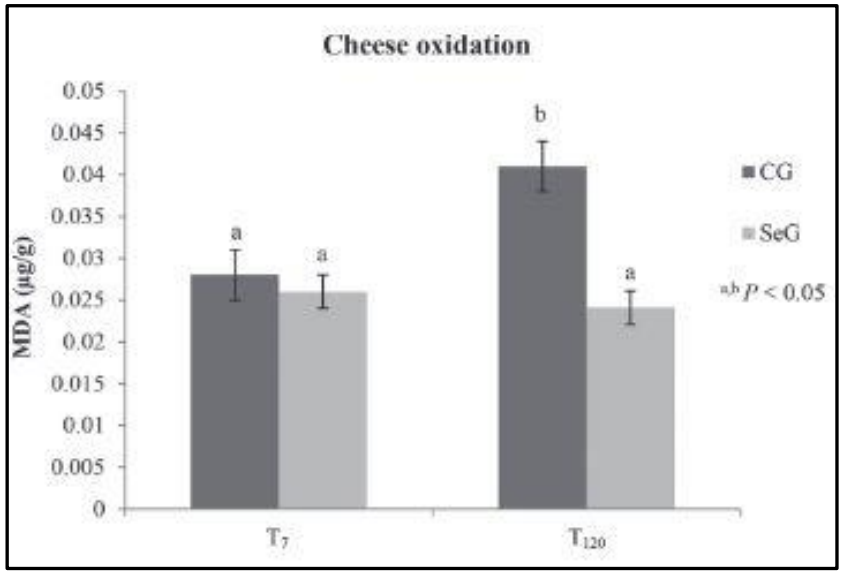
Effects of selenium supplementation on chemical composition and aromatic profiles of cow milk and its derived cheese

Andrea Ianni,[1] Francesca Bennato,[1] Camillo Martino,[2] Denise Innosa,[1] Lisa Grotta,[1] and Giuseppe Martino[1]*
[1]Faculty of BioScience and Technology for Food, Agriculture and Environment, University of Teramo, Italy 64100
[2]Department of Veterinary Medicine, University of Perugia, Italy 06126

Item	Milk		
	CG	SeG	*P*-value
C10:0	3.21 ± 0.23	3.08 ± 0.18	NS
C12:0	3.99 ± 0.31	3.87 ± 0.32	NS
C14:0	12.88 ± 1.05	12.22 ± 1.12	NS
C14:1	0.46 ± 0.05	0.68 ± 0.06	*
C15:0	1.23 ± 0.11	1.18 ± 0.08	NS
C16:0	36.55 ± 2.23	34.49 ± 2,31	NS
C16:1	1.55 ± 0.09	1.72 ± 0.12	NS
C17:0	0.55 ± 0.05	0.52 ± 0.05	NS
C18:0	8.72 ± 0.74	7.91 ± 0.71	NS
C18:1 *trans*-11	0.68 ± 0.06	0.73 ± 0.06	NS
C18:1 *cis*-9	15.95 ± 1.02	17.43 ± 1.13	NS
C18:1 *cis*-11	0.38 ± 0.04	0.45 ± 0.04	NS
C18:2	1.83 ± 0.16	2.21 ± 0.18	*
C18:3	0.46 ± 0.05	0.52 ± 0.05	NS
CLA *cis*-9,*trans*-11[2]	0.29 ± 0.03	0.38 ± 0.04	*
C20:4	0.19 ± 0.02	0.22 ± 0.02	NS
MUFA	19.02 ± 1.13	21.01 ± 1.65	NS
PUFA	2.77 ± 0.21	3.29 ± 0.28	NS
SFA	67.13 ± 2.09	63.47 ± 1.34	*



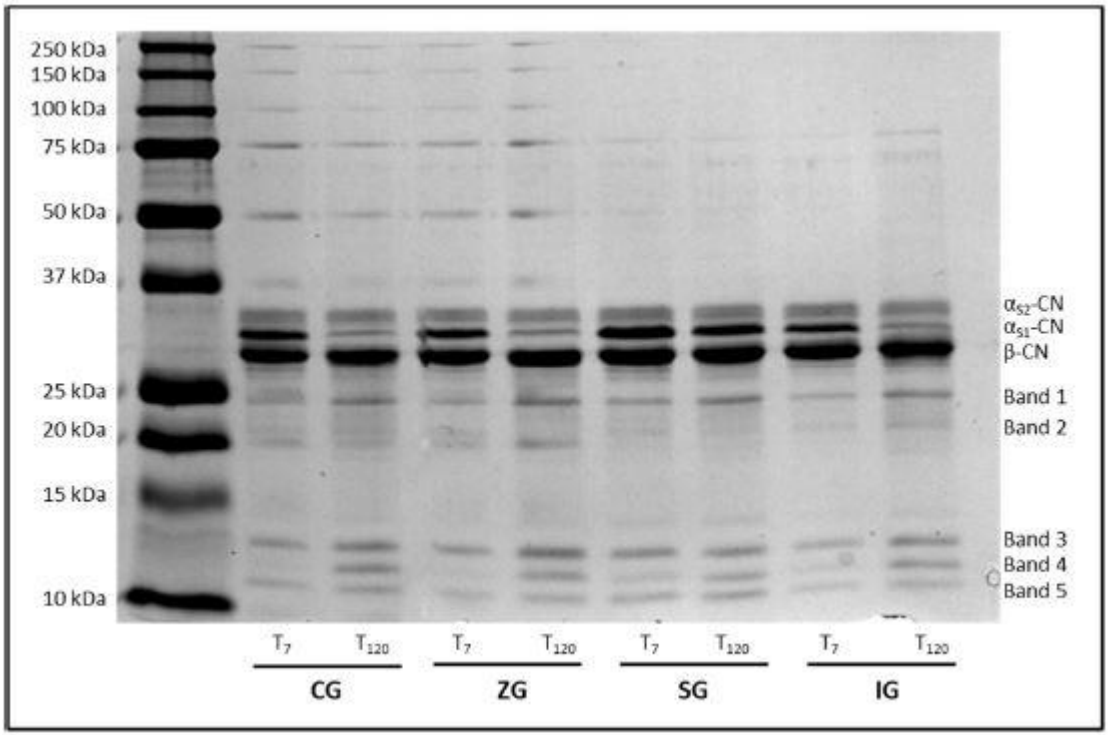
molecules

MDPI

Article

Proteolytic Volatile Profile and Electrophoretic Analysis of Casein Composition in Milk and Cheese Derived from Mironutrient-Fed Cows

Andrea Ianni [1,†], Francesca Bennato [1,†], Camillo Martino [2], Lisa Grotta [1], Nicola Franceschini [3] and Giuseppe Martino [1,*]



Animal (2020), **14:4**, pp 745–752 © The Animal Consortium 2019
doi:10.1017/S1751731119002477

animal

Whole-transcriptome profiling of sheep fed with a high iodine-supplemented diet

M. Iannaccone[1]*, R. Elgendy[2*a], A. Ianni[1], C. Martino[3], F. Palazzo[1], M. Giantin[2], L. Grotta[1], M. Dacasto[2] and G. Martino[1†]

[1]*Faculty of Bioscience and Technology for Food, Agriculture, and Environment, University of Teramo, Via R. Balzarini 1, 64100 Teramo, Italy;* [2]*Department of Comparative Biomedicine and Food Science, University of Padua, Viale dell'Università 16, 35020 Legnaro, Italy;* [3]*Specialist Diagnostic Department, Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale", Via Campo Boario, 64100 Teramo (TE), Italy*

animals

MDPI

Article

Iodine Supplemented Diet Positively Affect Immune Response and Dairy Product Quality in Fresian Cow

Marco Iannaccone [1,†], Andrea Ianni [2,†], Ramy Elgendy [3], Camillo Martino [4], Mery Giantin [5], Lorenzo Cerretani [6], Mauro Dacasto [5] and Giuseppe Martino [1,*]

Both in cows and sheeps, the pathways most affected by the dietary supplementation were involved in the immune response and the oxidative stress

Use of ozone for sanitizing the livestock premises and milking equipment

- ✓ Ozone is an oxidizing agent with antibacterial and antifungal activity
- ✓ Following use, it rapidly decomposes without releasing toxic compounds into the environment

Preservation and recovery of the zootechnical biodiversity in the Abruzzi region

Suino Nero d'Abruzzo
(black pig of Abruzzo)

Capra Teramana
(Goat of Teramo)

Gallina Atriana
(Laying hen of Atri)

Preservation and recovery of the zootechnical biodiversity in the Abruzzi region: The *"Black pig of Abruzzo"*

Black pig of Abruzzo

Vs

Commercial hybrid

Meat Fatty Acids Profile

	Black pig of Abruzzo	Commercial hybrid
C14:0	1,59 ± 0,11	1,52 ± 0,32
C16:0	27,32 ± 1,42	28,81 ± 1,75
C18:0	12,31 ± 1,06	13,78 ± 1,90
Saturated	**41,22 ± 1,55**	**44,11 ± 2,21**
C14:1	0,09 ± 0,02	0,06 ± 0,01
C16:1	2,87 ± 0,56	2,23 ± 0,53
C18:1 cis9	40,30 ± 1,69	39,56 ± 2,13
C18:1 cis11	2,19 ± 0,58	1,70 ± 0,19
Mono-unsaturated	**45,45 ± 2,29**	**43,55 ± 2,11**
C18:2	9,50 ± 0,95	8,46 ± 1,40
C18:3	0,92 ± 0,16	0,75 ± 0,14
Poly-unsaturated	**10,42 ± 0,88**	**9,21 ± 1,07**
Others	**3,11 ± 0,28**	**3,13 ± 0,26**

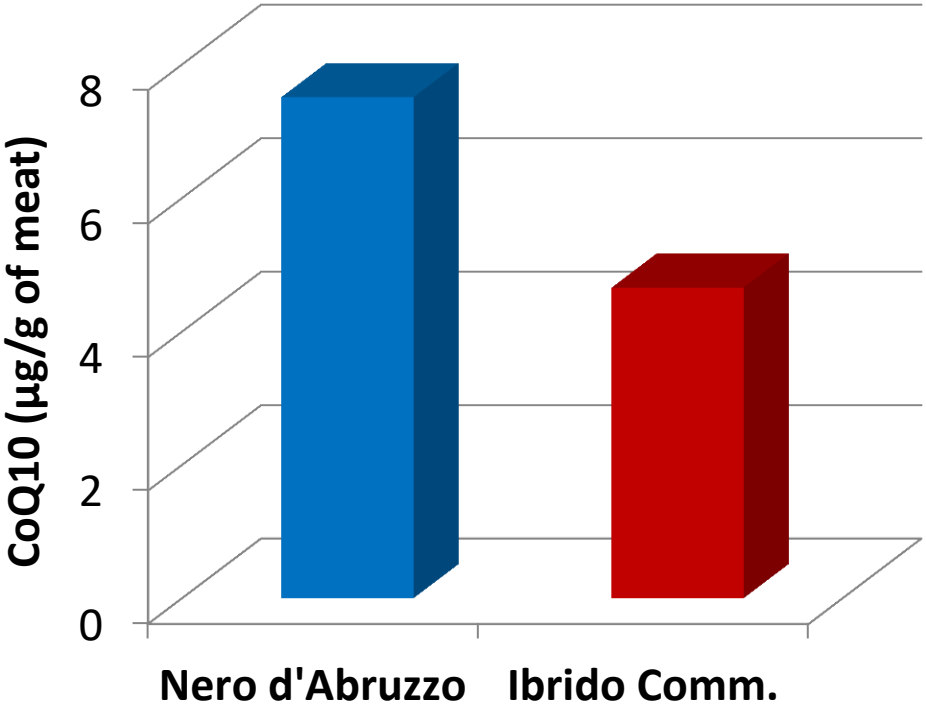
Black Pig of Abruzzo

Commercial Hybrid

Coenzyme Q10 in raw meat

Coenzyme Q10

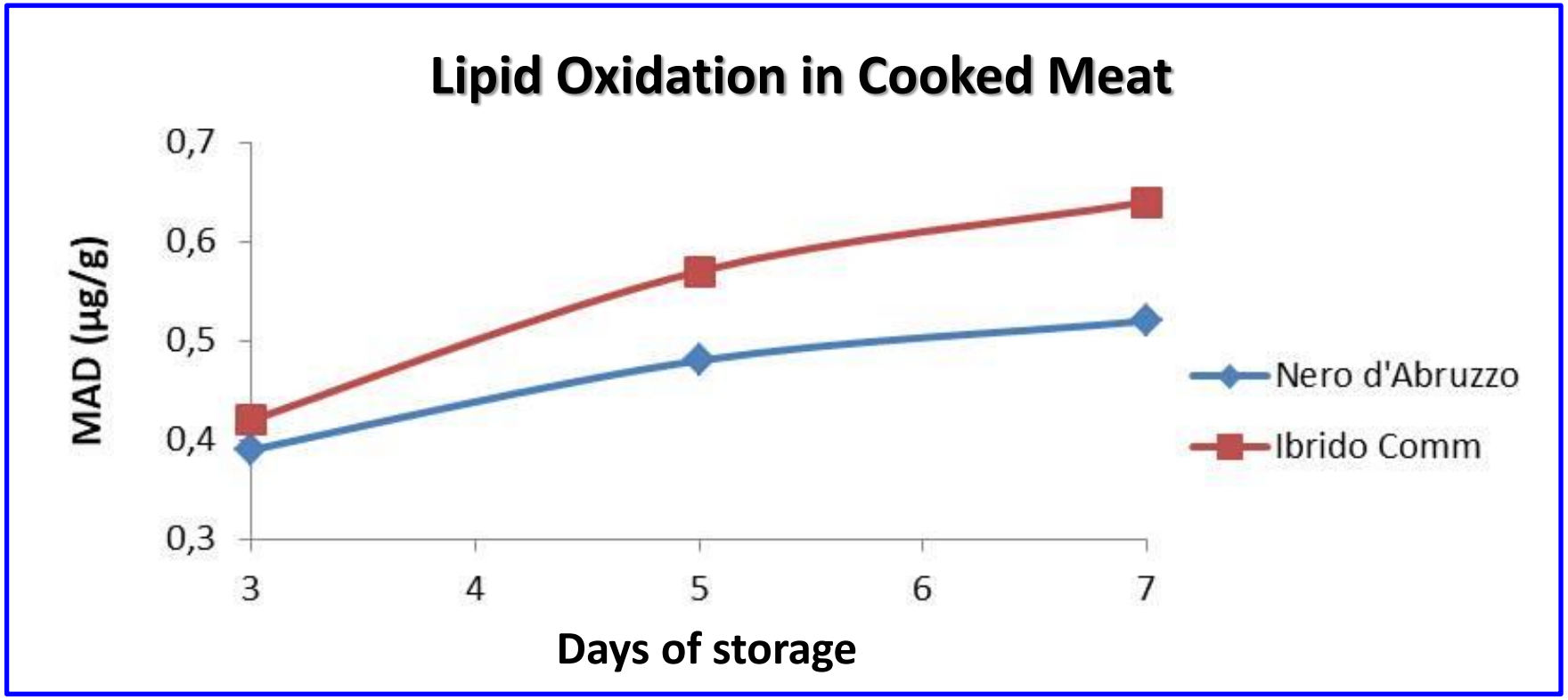
- **Fat-soluble compound involved in energy metabolism.**
- **Acts as an acceptor of free radicals with antioxidant (reducing) properties.**
- **Slows down the biotransformation of arachidonic acid by carrying out an anti-inflammatory action.**



Resistant to cooking!!!

Oxidative Stability of Cooked Meat

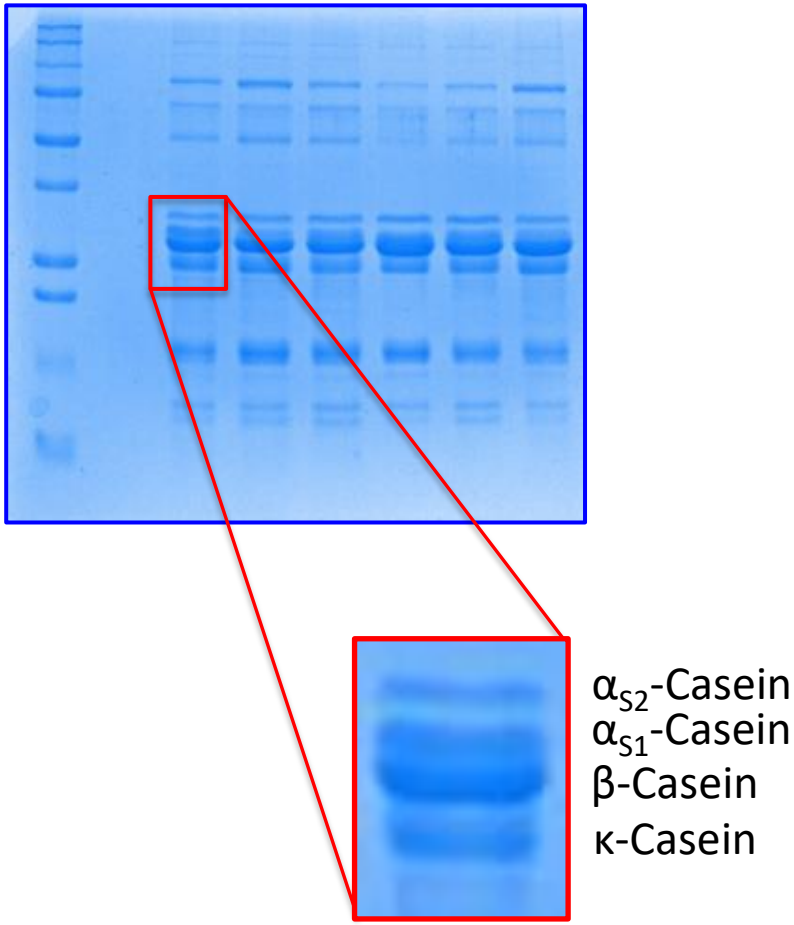
Days of Storage	Black pig of Abruzzo	Commercial Hybrid
Dopo 3gg	$0.39^{a} \pm 0.02$	$0.45^{b} \pm 0.03$
Dopo 5gg	$0.48^{a} \pm 0.04$	$0.57^{b} \pm 0.07$
Dopo 7gg	$0.52^{a} \pm 0.03$	$0.64^{b} \pm 0.08$



Preservation and recovery of the zootechnical biodiversity in the Abruzzi region: The *"Goat of Teramo"*

Fatty Acids Profile		
	Saanen	**Teramana**
C4:0	1,65 ± 0,08	1,75 ± 0,16
C6:0	2,23 ± 0,10	2,38 ± 0,20
C8:0	3,02 ± 0,11	3,12 ± 0,26
C10:0	11,20 ± 0,21	11,20 ± 0,85
C12:0	$5,21^{a}$ ± 0,03	$4,62^{b}$ ± 0,29
C14:0	$11,02^{a}$ ± 0,04	$9,84^{b}$ ± 0,24
C15:0	$1,06^{a}$ ± 0,01	$1,23^{b}$ ± 0,01
C16:0	$28,77^{a}$ ± 0,23	$26,42^{b}$ ± 0,44
C17:0	$0,63^{a}$ ± 0,01	$0,72^{b}$ ± 0,02
C18:0	$9,83^{a}$ ± 0,10	$11,00^{b}$ ± 0,52
C20:0	0,23 ± 0,00	0,23 ± 0,01
SFA	**$74,85^{a}$ ± 0,16**	**$72,50^{b}$ ± 0,97**
C14:1	$0,40^{a}$ ± 0,00	$0,43^{b}$ ± 0,00
C16:1	0,26 ± 0,01	0,25 ± 0,02
C18:1, t11	$1,10^{a}$ ± 0,03	$1,47^{b}$ ± 0,06
C18:1, c9	$16,03^{a}$ ± 0,16	$17,48^{b}$ ± 0,73
C18:1,c11	0,11 ± 0,02	0,08 ± 0,00
MUFA	**$17,90^{a}$ ± 0,17**	**$19,72^{b}$ ± 0,79**
C18:2	$1,31^{a}$ ± 0,01	$1,22^{b}$ ± 0,04
C18:3	$0,93^{a}$ ± 0,01	$1,06^{b}$ ± 0,04
CLA	$1,65^{a}$ ± 0,04	$1,80^{b}$ ± 0,07
PUFA	**3,89 ± 0,04**	**4,07 ± 0,14**
Altri	$3,36^{a}$ ± 0,03	$3,71^{b}$ ± 0,09

Caseins Characterization



Preservation and recovery of the zootechnical biodiversity in the Abruzzi region: The *"Hen of Atri"*

animals MDPI

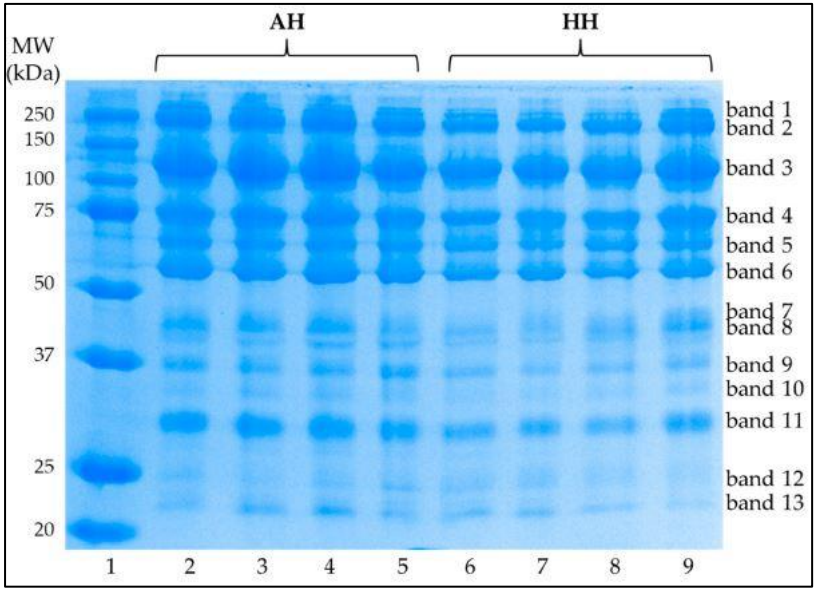
Article

Egg Quality from Nera Atriana, a Local Poultry Breed of the Abruzzo Region (Italy), and ISA Brown Hens Reared under Free Range Conditions

Andrea Ianni, Dayana Bartolini, Francesca Bennato and Giuseppe Martino *

Table 4. Fatty acid profile in egg yolks obtained from commercial hybrid hen (HH) and Nera Atriana laying hen (AH).

Fatty Acids [1]	HH	AH	*p* Value
C14:0	0.43 ± 0.05	0.45 ± 0.06	ns
C16:0	24.79 ± 2.06	28.58 ± 2.51	**
C18:0	8.49 ± 0.87	9.46 ± 1.07	ns
SFA	33.71 ± 3.08	38.49 ± 3.27	**
C16:1 cis-9	1.92 ± 0.23	2.94 ± 0.28	*
C18:1 cis-9	44.53 ± 3.83	39.31 ± 3.35	*
MUFA	46.45 ± 4.01	42.25 ± 3.71	ns
C18:2 cis-9, cis-12	14.34 ± 1.32	14.13 ± 1.40	ns
C18:3 cis-9, cis-12, cis-15	0.38 ± 0.05	0.30 ± 0.04	ns
C20:4 cis-5, cis-8, cis-11, cis-14	2.25 ± 0.19	2.12 ± 0.21	ns



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Dott. Marco Florio

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Grazie per l'attenzione!