A comparison of health status and milk quality in dairy cows reared in nearby areas of Italy and Slovenia

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Reasons to invest on Animal Welfare issues

- ***Public concerns** for animal living conditions*
- ***[EU / National] Regulation** and Legislation*
- *Enhancement of **herd health** and reducing cost related diseases*
- *Increase animal performances and **[quality / safety] of food***
- *Valorization of **social and ethical role of farmers***

Methods to evaluate animal welfare

DIRECT METHODS:

- **Physiological parameters** *(rumination, breathing acts, heart rate,* ***biomarkers in tissues and biological fluid****s)*
- **Clinical and related parameters** *(BCS, cleaness, injuries, parasites, clinical illness, external conditions of body, laminitis)*

INDIRECTS METHODS:

- **Behavioural parameters** *(evaluation of animal-animal and animal- human interaction; comfort evaluation)*
- **Productive parameters** *(amount and quality of productions)*
- **Environmental parameters** *(farm structures and management)*
- **Feeding parameters** *(ration composition and requirements)*

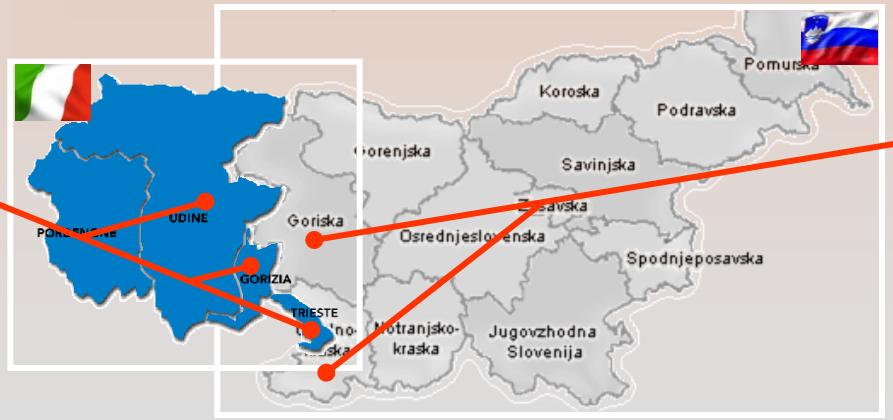
The project

The research activity within a Interreg IIIA Italia/Slovenia project

Italian Partners: 1) **Department of Animal Sciences, University of Udine** ***2)*** **Breeders Association of Friuli Venezia Giulia region**

Slovenian Partners: 1) **Department of Zootechnical Sciences University of Lubiana** ***2)*** **Chamber of Agriculture and Forests of Slovenia - Nova Gorica Department**

Udine
Gorizia
Trieste



Obalno-Kraska
Goriska

Aims

1) **Cooperation among Research Institutions to harmonize production systems**

2) ***Evaluation of animal welfare conditions, by mean of a survey realized on 22 Italian and Slovenian dairy farms during two consecutive years***

3) **Evaluation of welfare status on the qualitative characteristics of milk and milk products**

The transition cow: a spontaneous model for welfare studies

High susceptibility to stress in the three weeks before calving and during the first and the second month of lactation.

Main causes of illness

1. Reduction of immunity in consequence to lower neutrophyls and linphocytes activity (increase of steroidal hormones, dietary imbalance);
2. Activation of inflammatory acute phase response before and after calving and intake reduction;
3. Metabolic variations like lipomobilization to balance the energy deficit of early lactation;
4. Imbalanc of rations;
5. Management;

Classification of farms in High and Low input according to:

- *Number of animals per farm*
- *Percentage of forage/hay in the ration*
- *Individual level of milk yield*
- *In-farm production of feedstuffs*
- *Number of animal / ha of utilizable land*

The sampling for the survey (two consecutive years)

Farms, #	Italy	Slovenia	Total
High input	6	7	13
Low input	6	3	9
Total	12	10	22
Animals	198	148	346

In each farm, 12-22 cows were chosen within a maximum of 60 days from calving

Samples within 30-60 DIM

- **Ration and feedstuffs**

  DM, CP, Lipid, Ash, NDF, Starch

- **Milk**

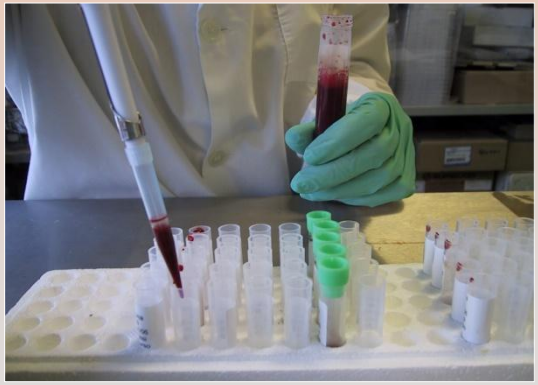
  Protein, fat, ash, lactose, SSC, CFU

- **Blood**

  jugular vein, before morning meal

Biomarkers in blood

Energy metabolism	*Inflammation*	*Oxidative stress*
FFA	Total proteins	GPx
β-OHB	Albumin	Hb
Glucose	Globulins	MDA
GOT	Haptoglobin	NOx
GGT	Ceruloplasmin	



Statistical analysis

Mixed model:

Fixed effect for Country, Year

Random effect for Farm

Classification analysis

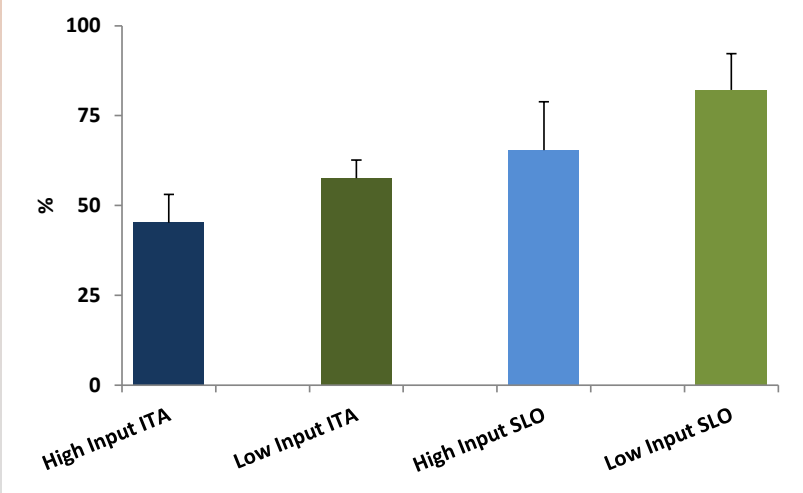
Discriminant analysis with *two set of independent variables:* *milk and blood*

RESULTS

Ingredients of the rations

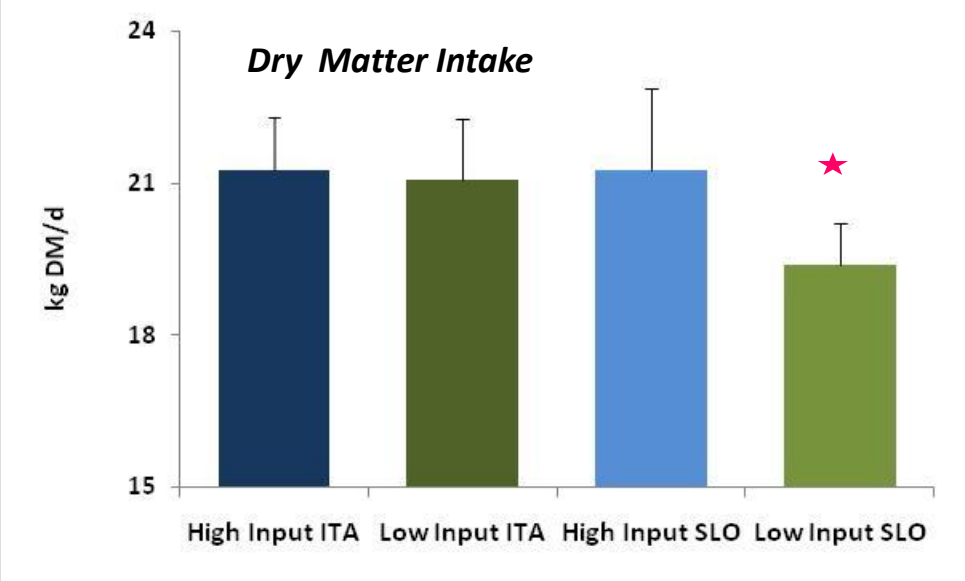
	Hay		Concentrate		Corn silage		Grass silage	
	mean	sd	**mean**	sd	**mean**	sd	**mean**	sd
High Input ITA	**351**	136	**397**	79	**252**	110	**0**	**0**
Low Input ITA	**485**	178	**424**	50	**91**	181	**0**	**0**
High Input SLO	**90**	102	**266**	135	**161**	87	**484**	**166**
Low Input SLO	**441**	266	**179**	101	**0**	0	**380**	**262**

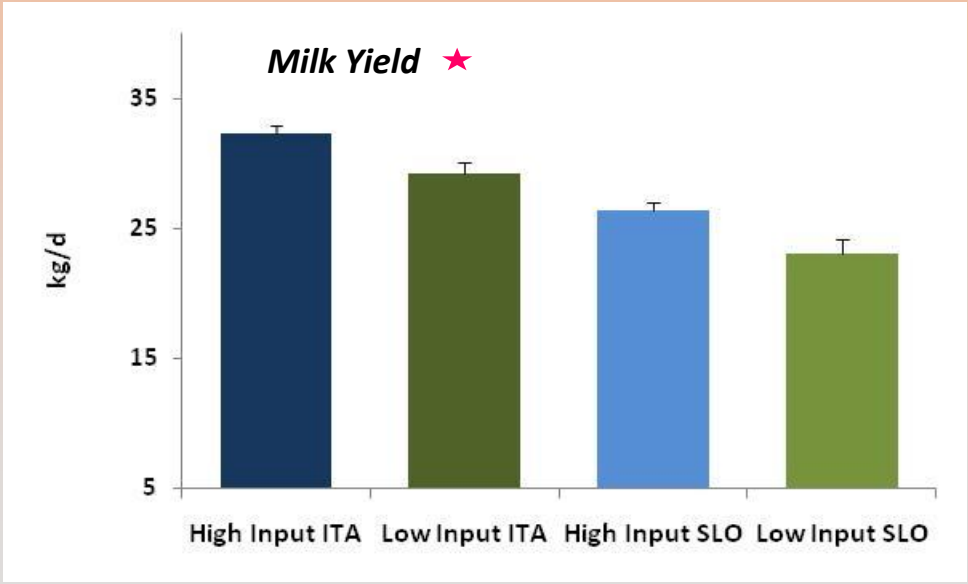
Percentage of forage in the diet



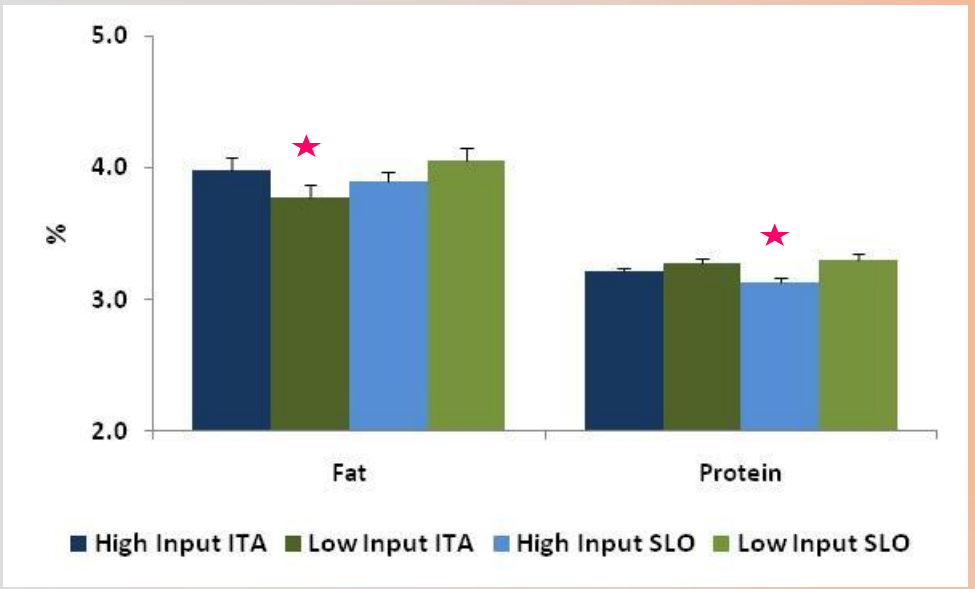
Chemical composition of the rations

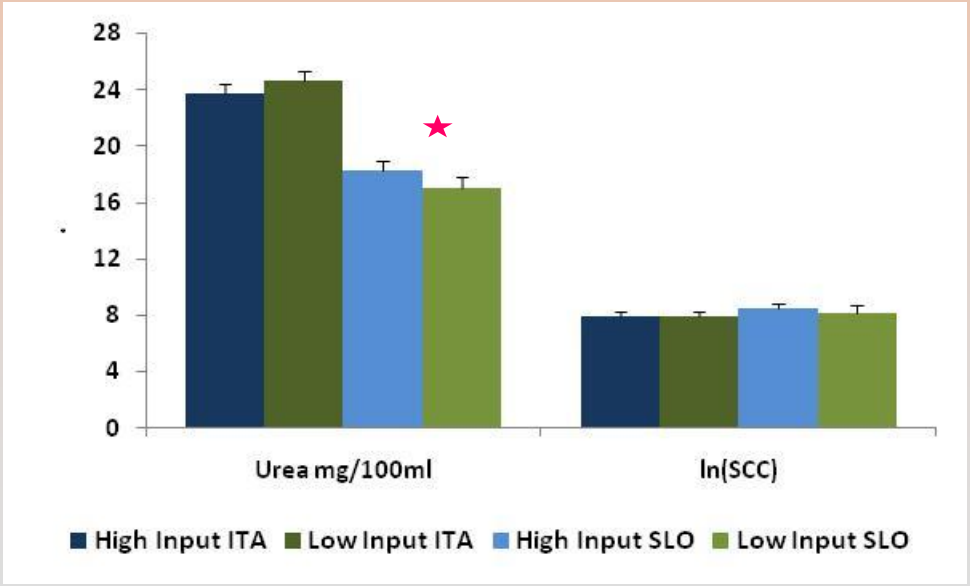
	Crude Protein		NDF		Starch		Lipids	
	mean	sd	mean	sd	mean	sd	mean	sd
High Input ITA	**15.8**	1.1	**40.4**	3.8	**23.4**	2.9	**3.2**	0.8
Low Input ITA	**15.1**	2.1	**42.8**	6.8	**24.0**	3.1	**2.4**	0.3
High Input SLO	**14.1**	2.1	**42.1**	6.2	**13.8**	2.7	**2.8**	0.3
Low Input SLO	**12.8**	2.8	**49.8**	8.1	**10.8**	4.0	**2.3**	0.3


Dry Matter Intake
24
21
18
15
kg DM/d
High Input ITA
Low Input ITA
High Input SLO
Low Input SLO

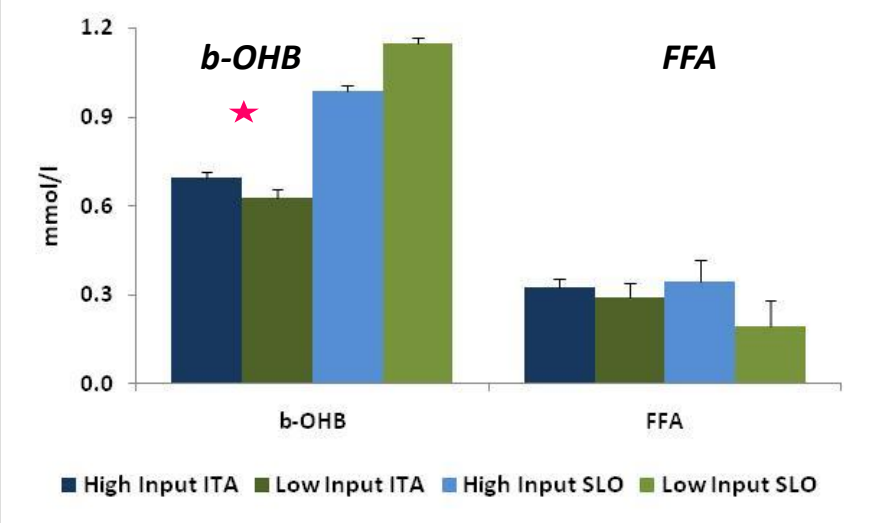

Milk Yield
35
25
15
5
kg/d
High Input ITA
Low Input ITA
High Input SLO
Low Input SLO

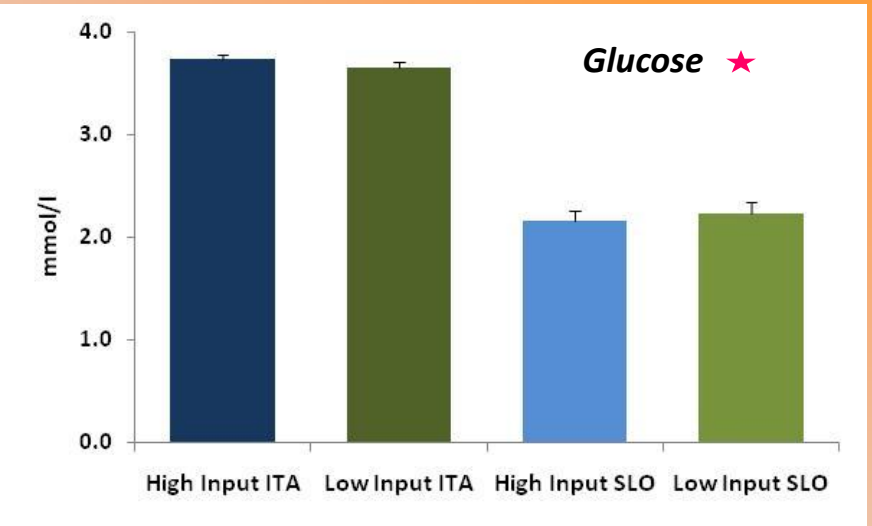
Milk analysis

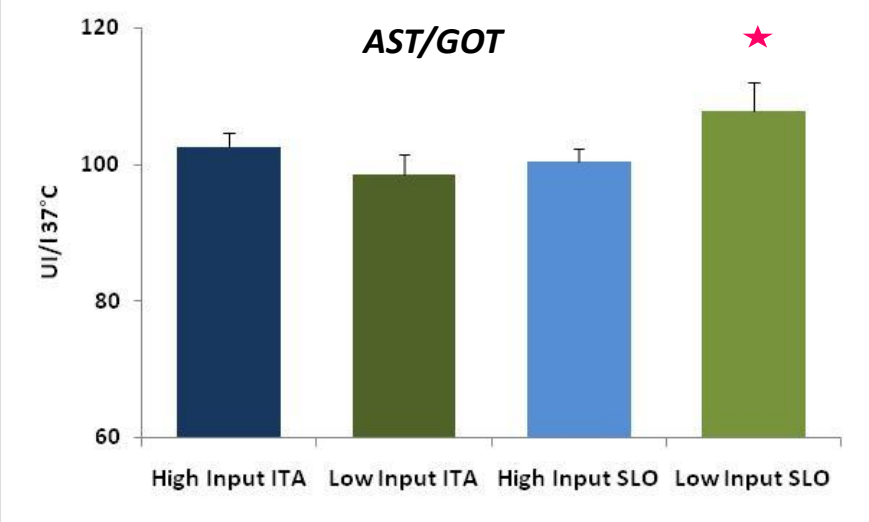


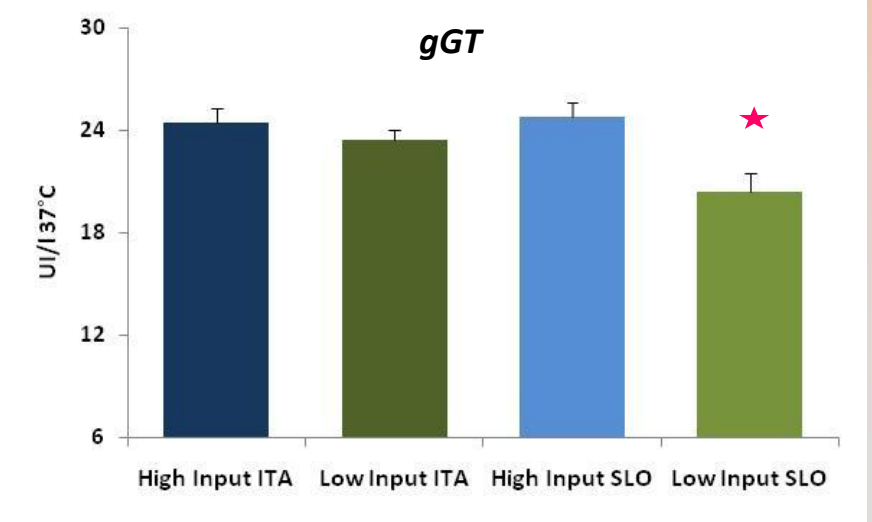


BIO-markers of energy balance / liver functions

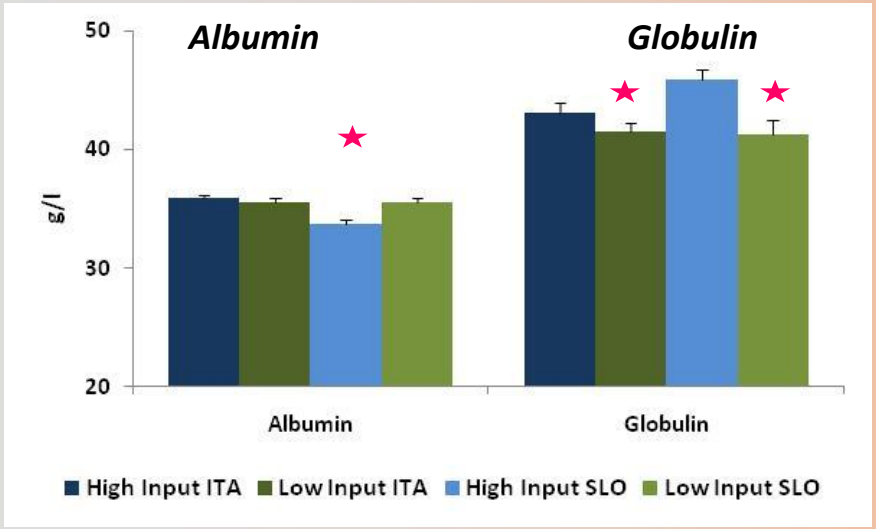


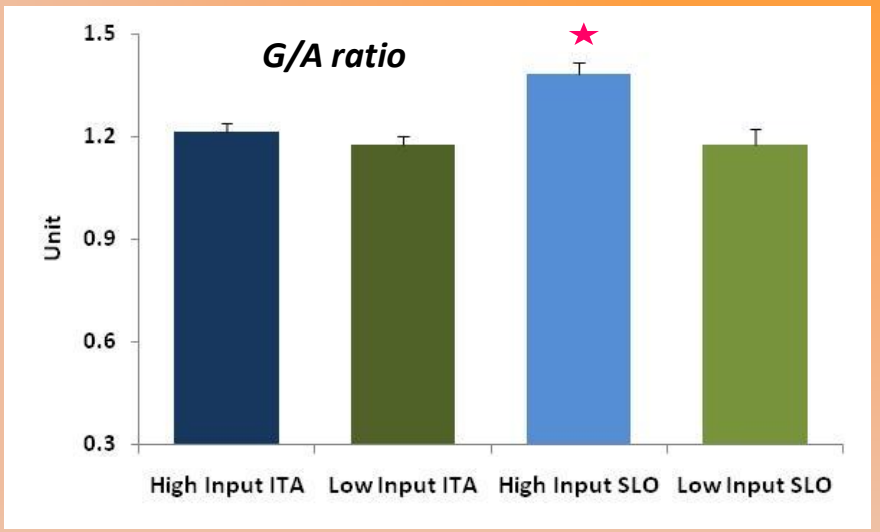


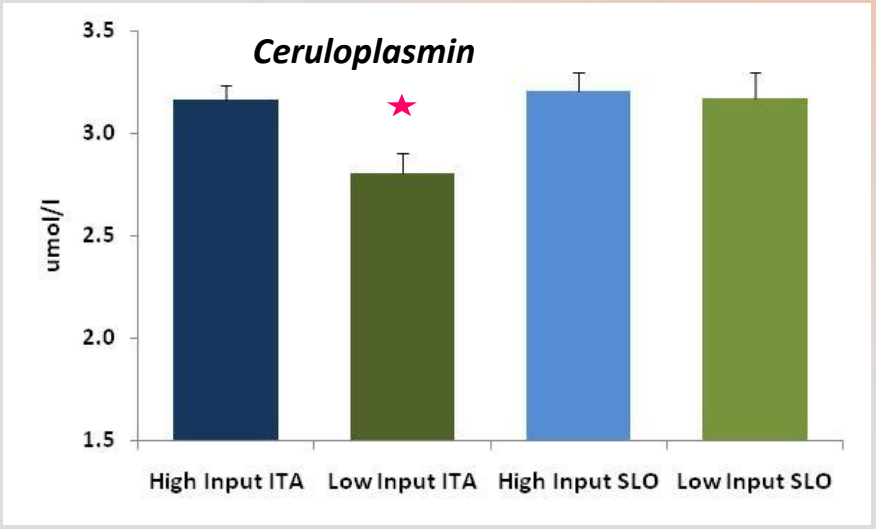


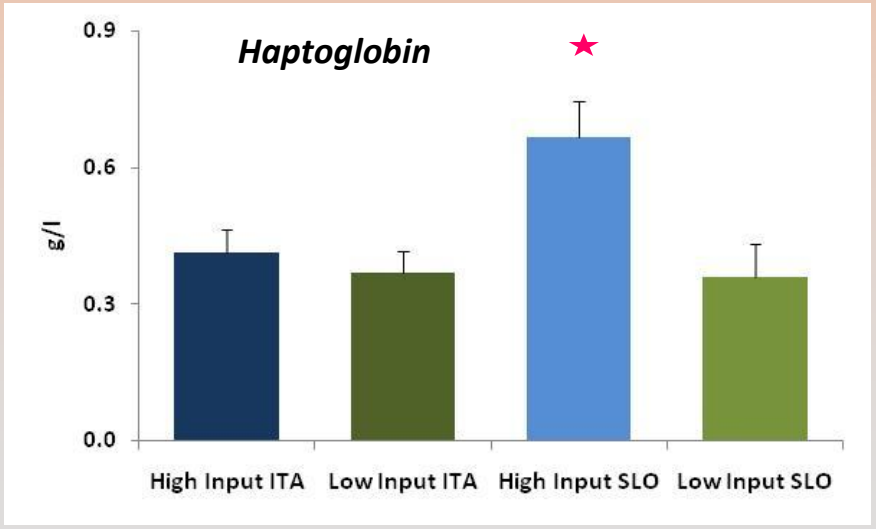


BIO-markers of inflammation

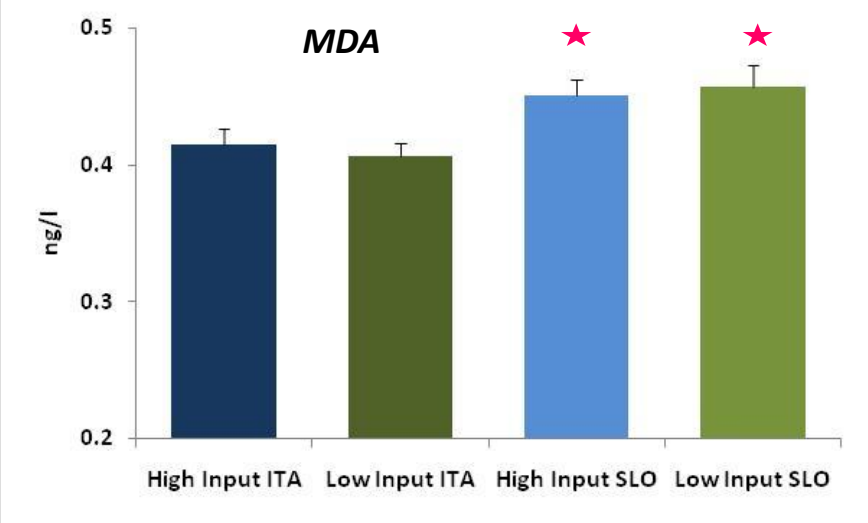


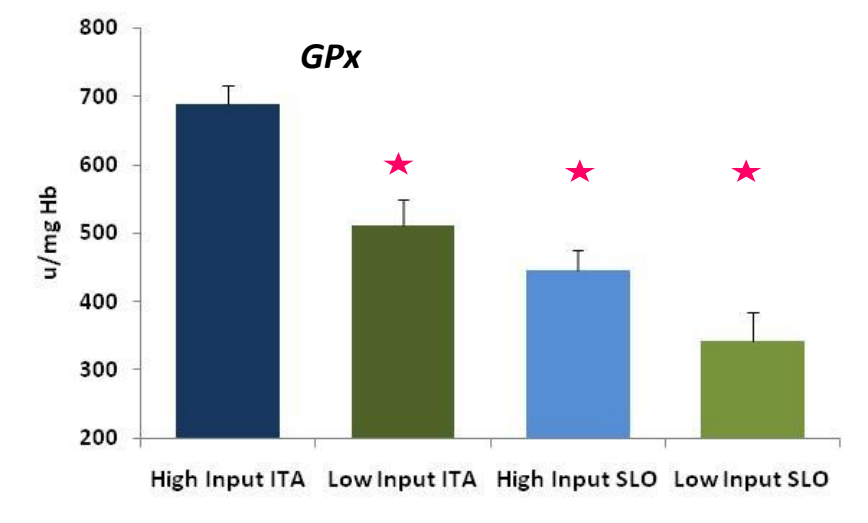






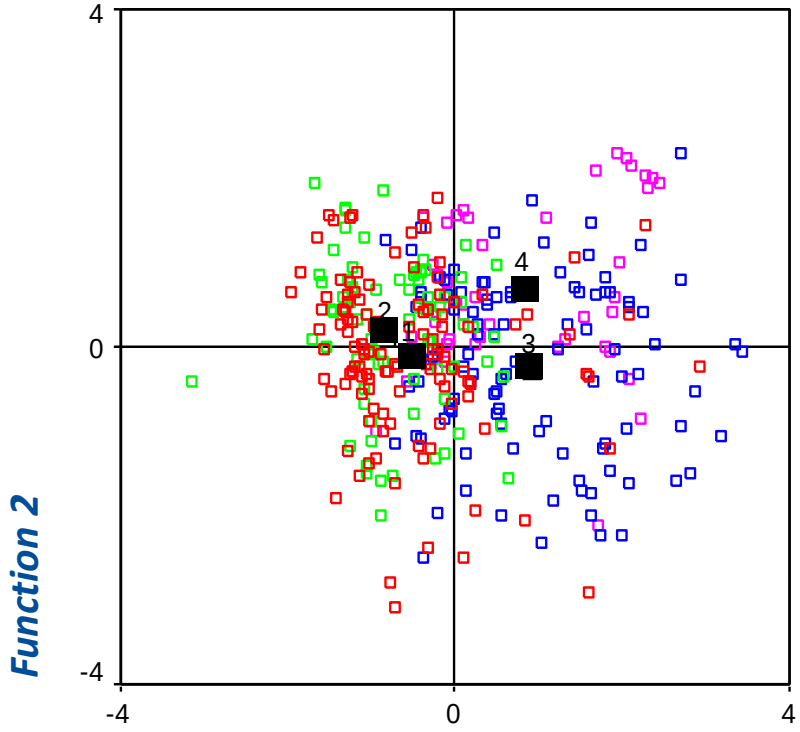
BIO-markers of oxidative STRESS





Milk as discriminant variables for high input Vs low input

Canonical discriminant functions



High input SLO

Low input SLO

High input ITA

Low input ITA

Eigenvalues

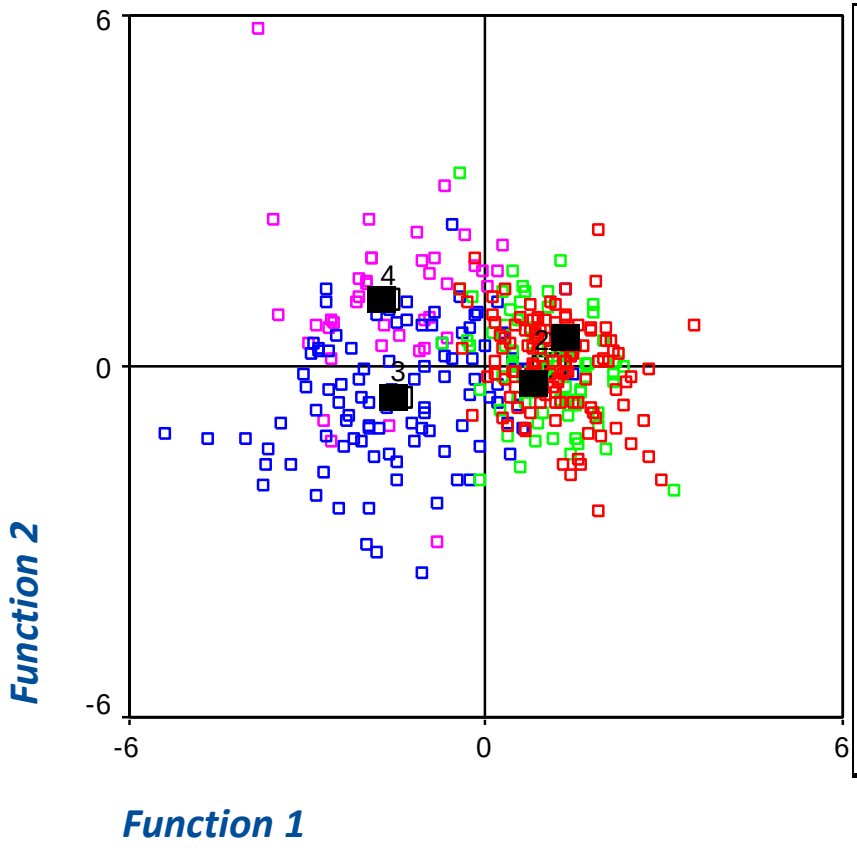
Function	Eigenvalue	% Variance	Cumulative %	Can_Corr	P <
1	0.40	73.7	73.7	0.536	0.000
2	0.11	20.0	93.8	0.314	0.000

Standardized Canonical Discriminant

	1	2	3
Protein	0.220	0.565	-0.443
Lactose	0.553	0.755	0.067
ln(SCC)	0.572	0.461	1.795
ln(CFU)	-0.459	-0.423	-1.091
Urea	0.780	-0.633	-0.127
SNF	0.588	-0.123	0.907

Blood as discriminant variables for high input Vs low input

Canonical discriminant functions



Eigenvalues

Function	Eigenvalue	% Variance	Cumulative %	Can_Corr	P <
1	1.62	84.8	84.8	0.786	0.000
2	0.20	10.6	95.4	0.410	0.000

Standardized Canonical Discriminant

	1	2	3
GPx	.166	-.315	.726
Glucose	**1.089**	.010	-.073
AST/GOT	.074	**.600**	.165
gGT	.158	-.379	-.097
FFA	.381	-.592	-.065
bOHB	.022	.113	.286
MDA	.146	-.020	.336
Protein	**-.734**	**-.668**	.435
Albumin	.598	**1.159**	.014
G/A ratio	**.755**	.802	-.207
Ceruloplasmin	-.217	.312	.549
Hatpglobin	.010	-.090	-.161

High input SLO

Low input SLO

High input ITA

Low input ITA

Considerations

*Data derive from a **survey of farms in contiguous area**, but with different ration compositions, nutritive content, animal genetic and management*

*In both Countries, **Low Input is not a synonimous** of improved physiological conditions, lower stress and higher food quality*

*It seems that **dietary factors are critical for animal welfare** after calving in dairy cows: **also in mild producing dairy cows, nutritional imbalance contributes to push animals in a proinflammatory conditions***

Selected biochemical analysis in blood are reliable biomarkers to depict the physiological conditions of dairy cows