Health and Metabolism as Reflected by Calves Plasma Redox State

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Studying Production Efficiency

Nutrition

Pomegranate

Olive pom.

Woodland

Reduce sickness (BRD, Tick fever)

Increase feeding efficiency

Physiology

Protein depr.

Caloric restr.

temperament

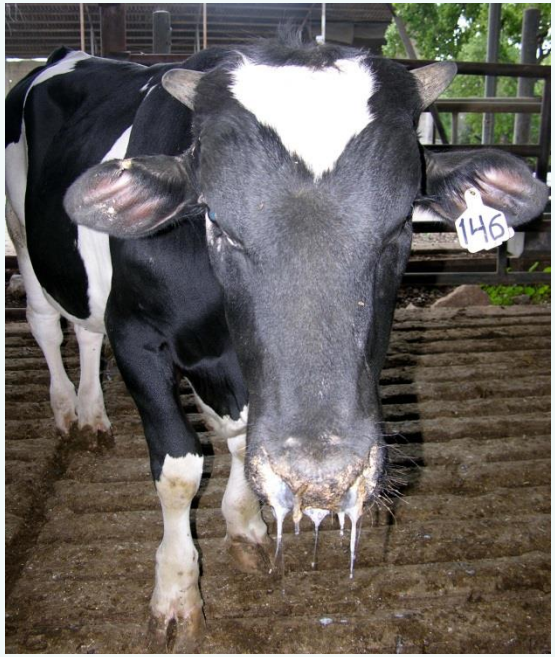
Baladi

Outline

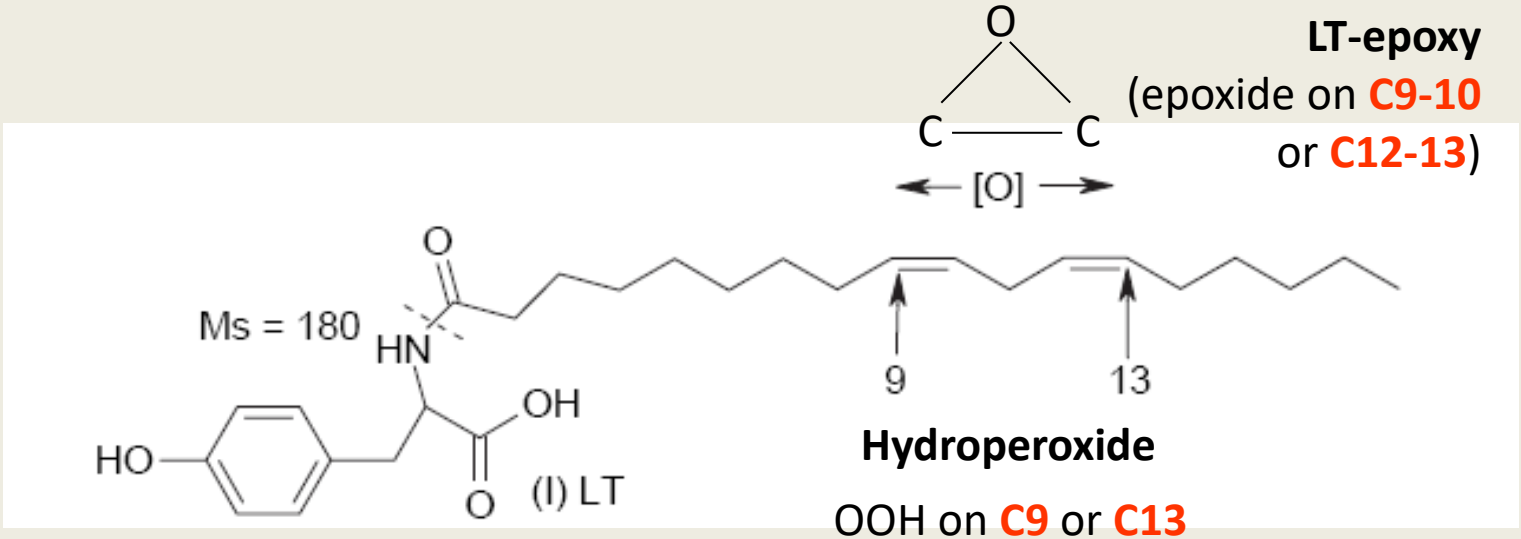
- Early detection of BRD as a potential key to control disease-related production loss.
- Manipulating production efficiency through management.

Bovine Respiratory Disease Complex (BRD)

- ✓ The leading cause for morbidity and mortality of young calves
- ✓ Triggered by transportation, weaning, biotic and abiotic factors
- ✓ Causes annual losses of 1 billion dollar (USA)
- ✓ Modulation of immune function
- ✓ Is correlated with oxidative stress
- ✓ Affects Kosher status of the meat, a retrospective phenotype for BRD episodes at early age

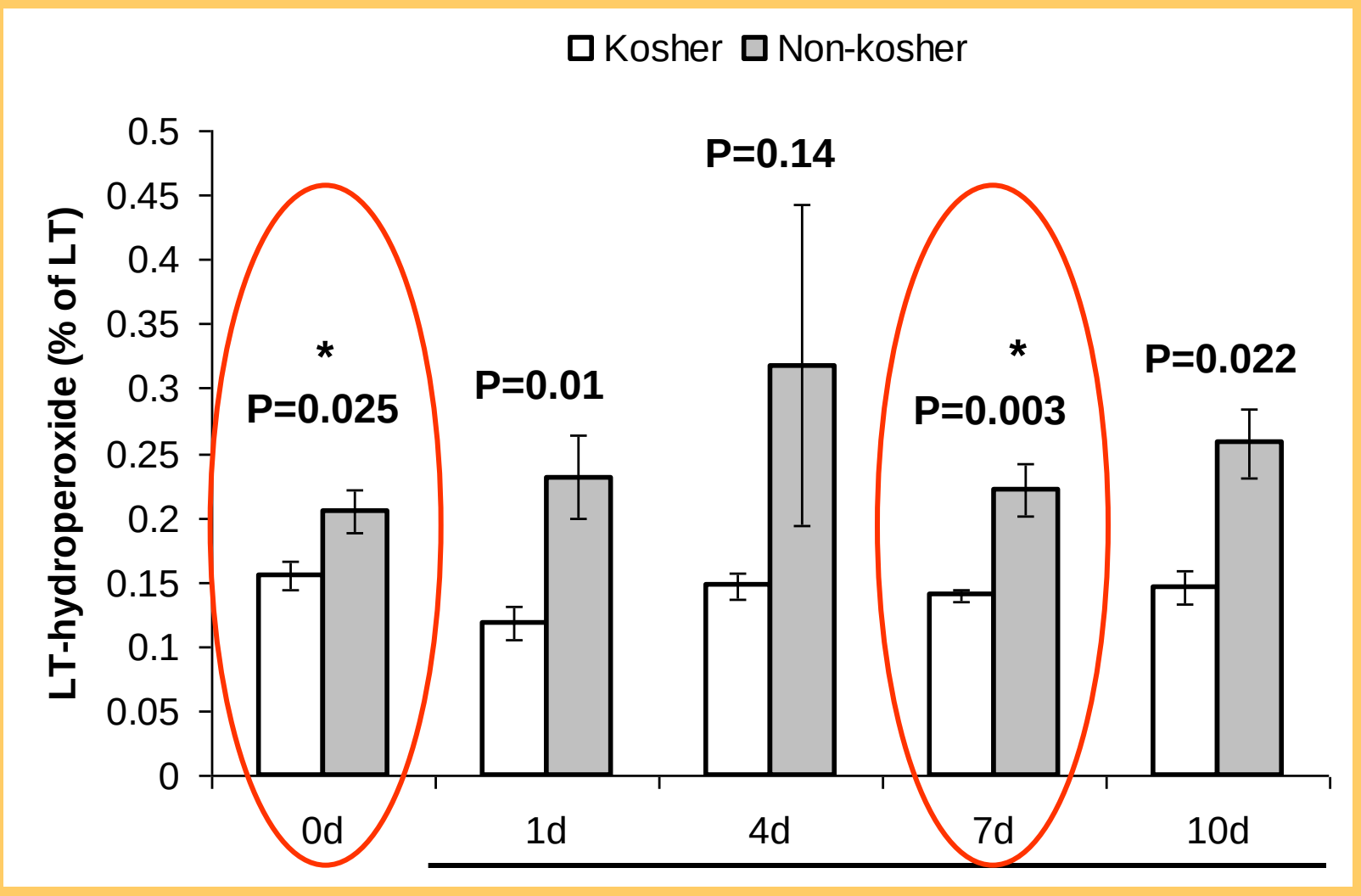


LT:
Exogenous marker that evaluates oxidative stress



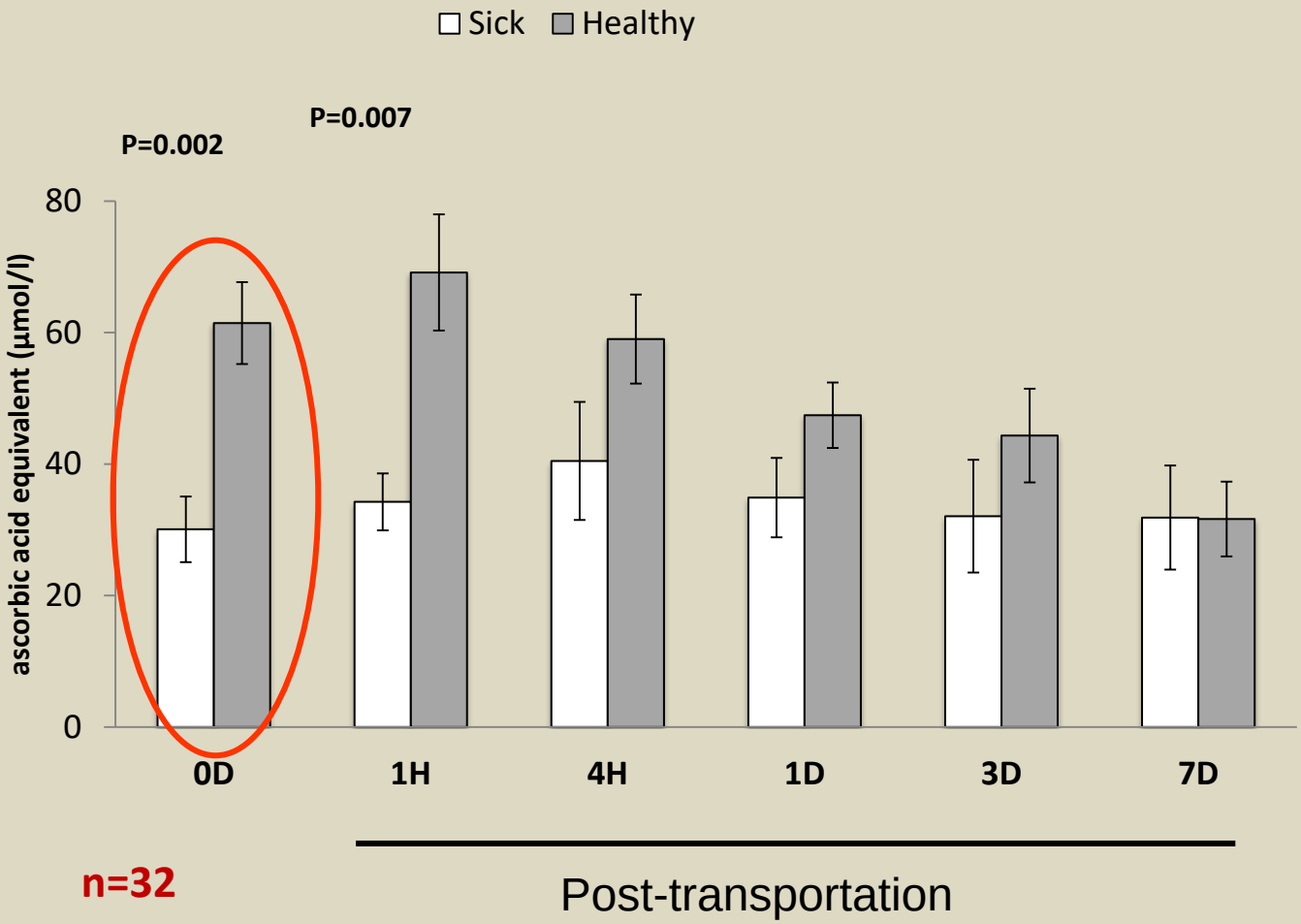
Szuchman et al., 2006; 2008

Early prediction of Kosher state

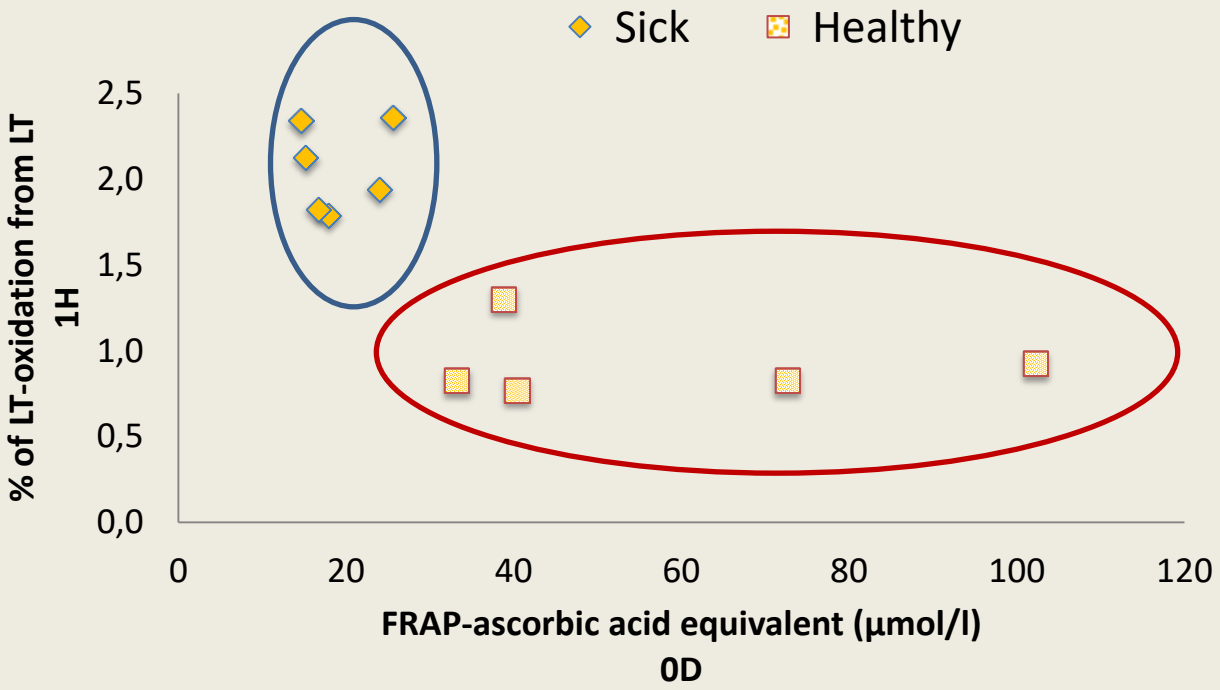


Eitam et al., 2010

Plasma redox state at age 5d is may predict future BRD sickness at age 3 months

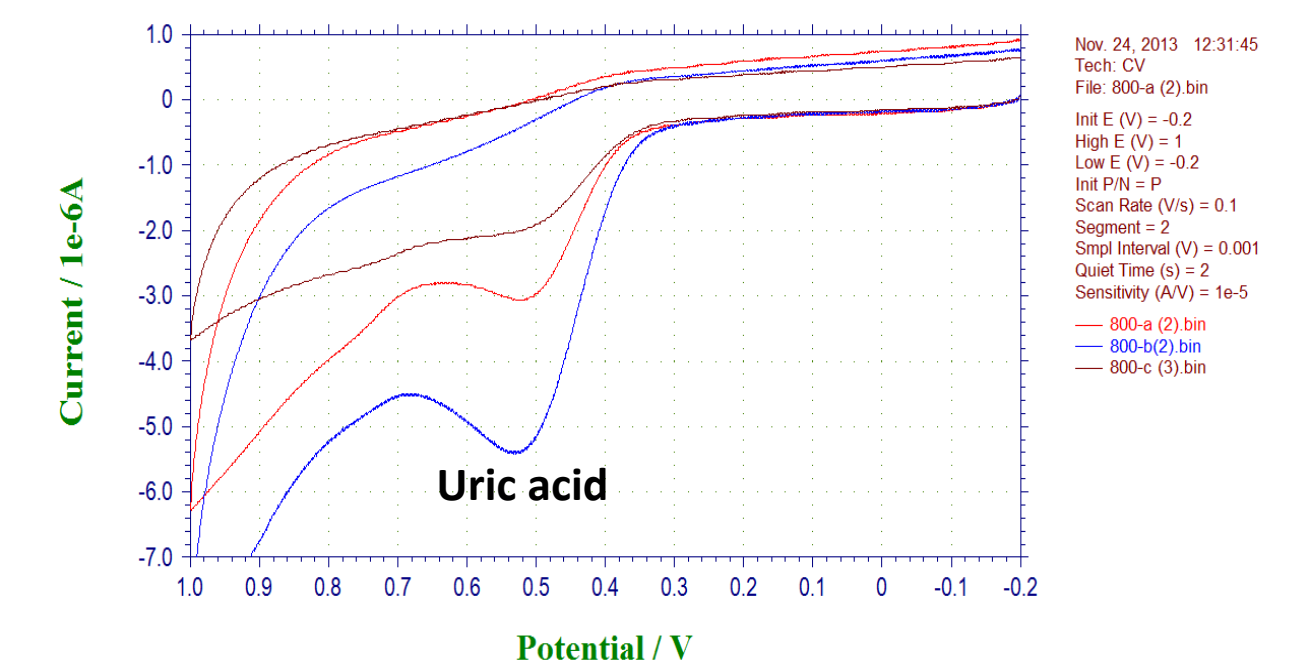


Plasma redox state is inversely related to LT oxidation



Healthy individuals are characterized by higher plasma redox potential attributed to uric acid

(CV method)



	1H/0D	1D/0D
Healthy	**2.32±0.32 a***	1.88±0.26 a
Sick	**1.28±0.16 b**	1.38±0.24 a

P=0.002

linear discriminant analysis; LDA

- The model predicts correctly 93.1% of Healthy vs Sick classifications (P=0.031)
- 2 individuals, one from each group were wrongly classified
- **FRAP 0D (redox state)** is the most efficient measure
- **IgG 0D** is the less efficient measure

	Function
FRAP - 0D	.617
Marketing age	-.526
ADG	.359
Cortisol 0DW	-.335
Creatinine 7DW	.284
FRAP - 1H	.277
Glucose 7DW	-.273
Lactate 3DW	-.271
Transportation	.156
IgG	.022

	Centroids
TREAT	
Healthy	1.127
Sick	-1.208

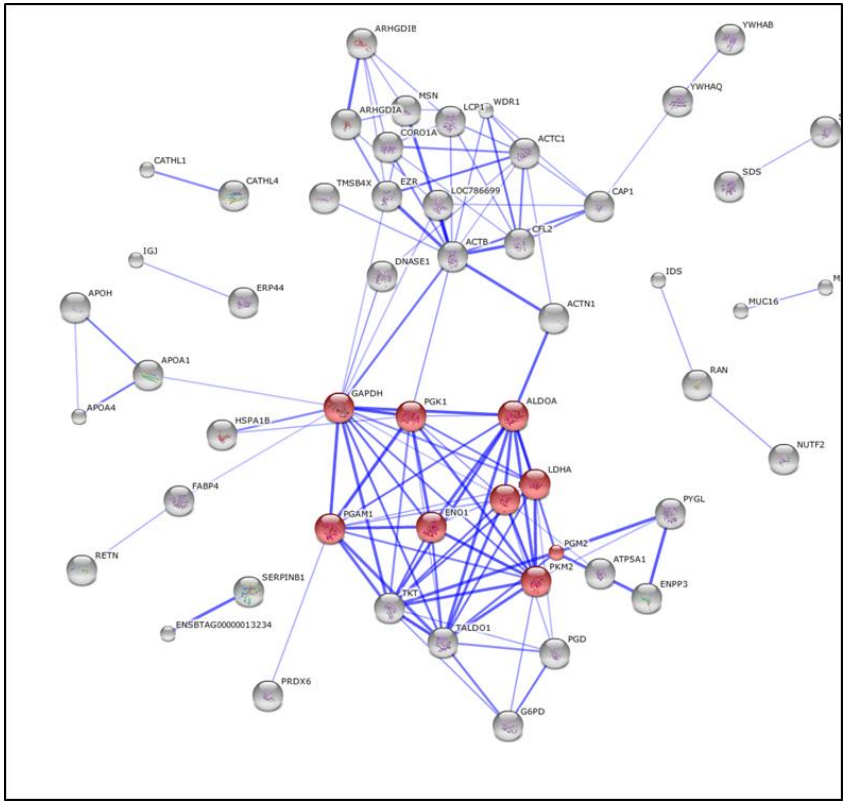
Classification Results[a]

			Predicted Group Membership		
		TREAT	1	2	Total
Original	Count	1	14	1	15
		2	1	13	14
	%	1	93.3	6.7	100
		2	7.1	92.9	100

a. 93.1% of original grouped cases correctly classified.

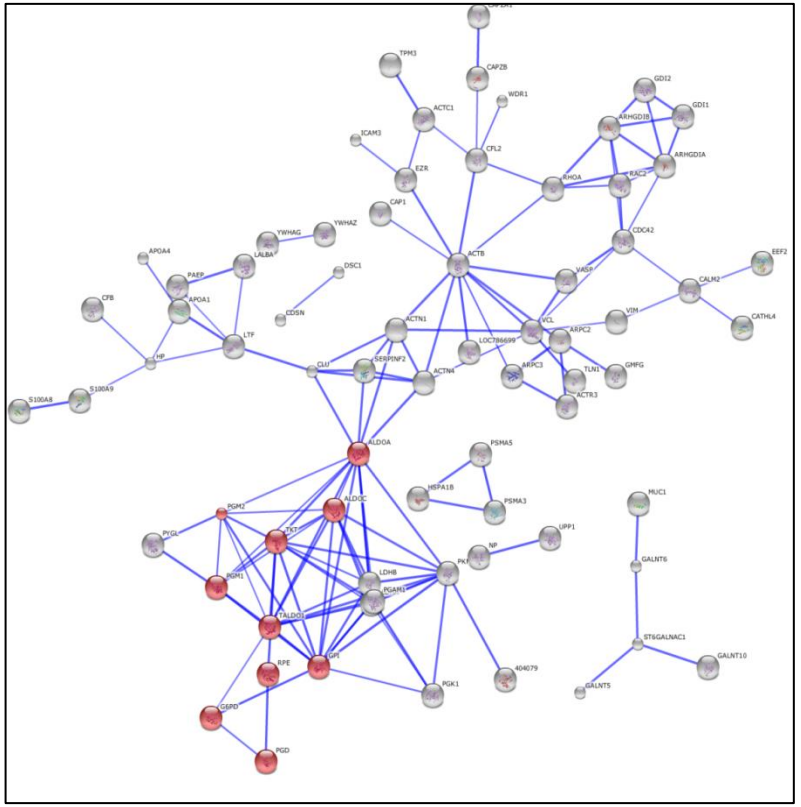
Oral fluids proteomics : Predictive protein profile

Glycolysis/Gluconeogenesis Pathways
Age: 1-7 days



$P = 6 \times 10^{-10}$

Pentose-Phosphate Pathway
Age: 2 months

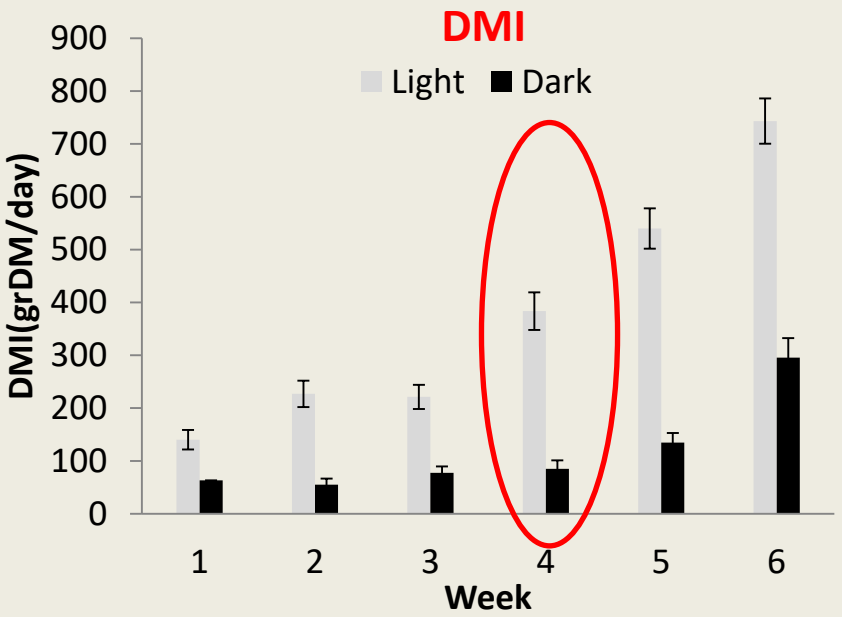


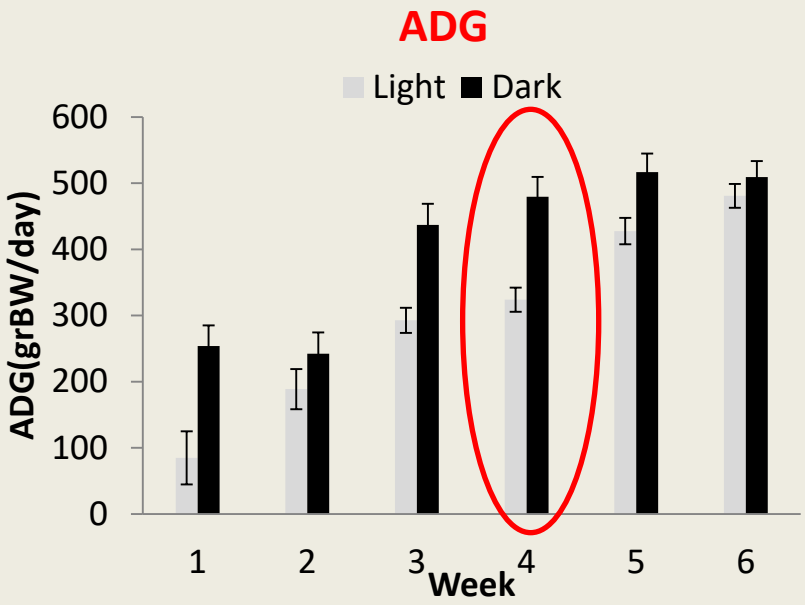
$P = 2.4 \times 10^{-13}$

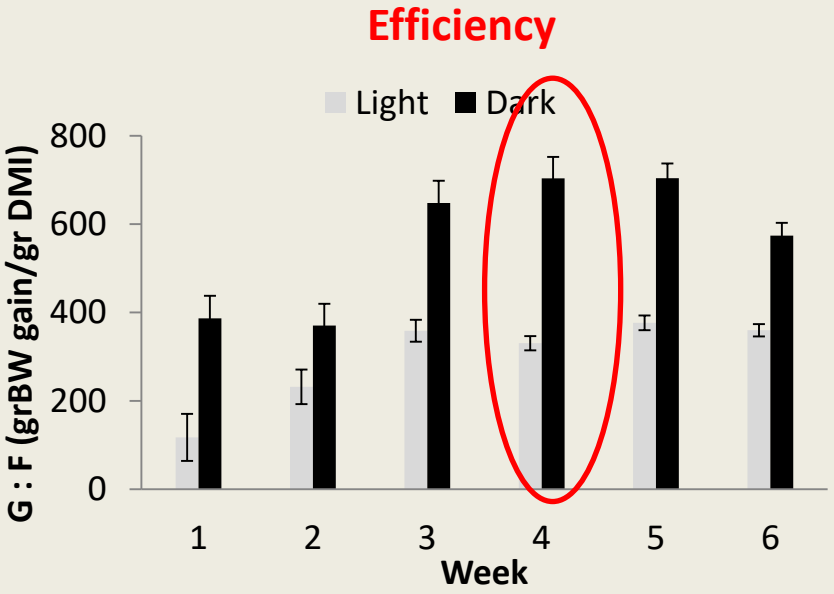
Expression of these metabolic pathways distinguishes healthy from future BRD animals, implying involvement of metabolic rate/redox state

Affecting production efficiency through management manipulations (light regime)

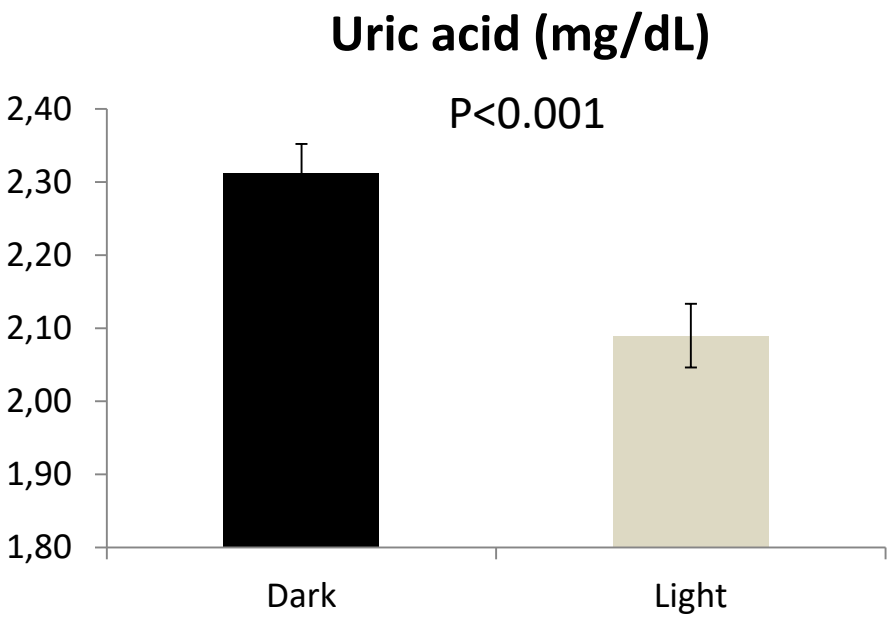
Artificial light at night: negative effects on feeding efficiency

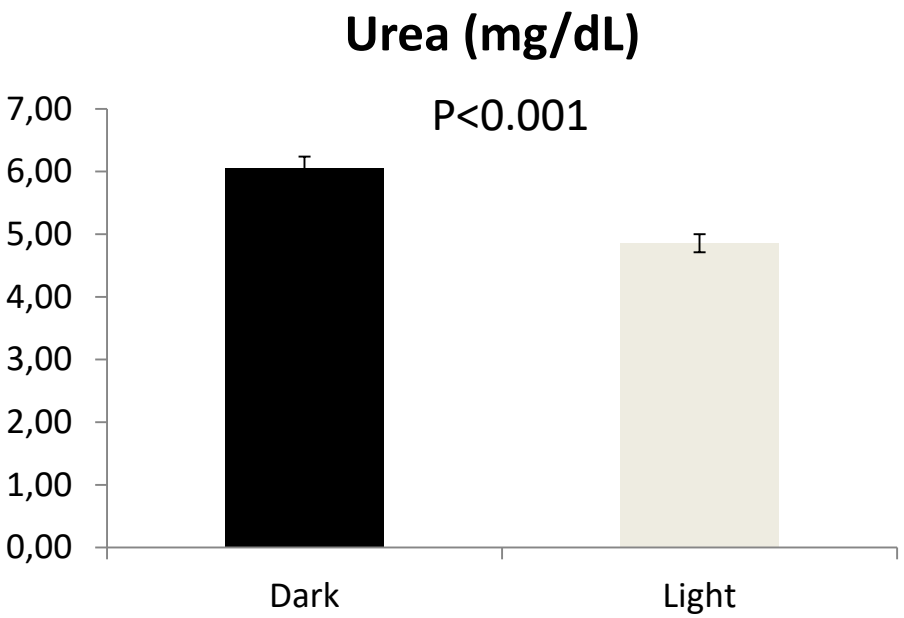


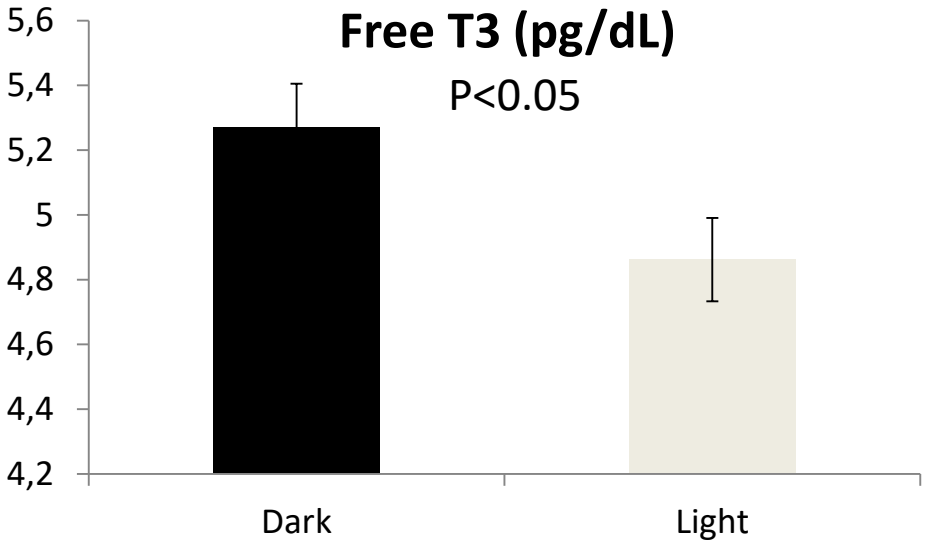




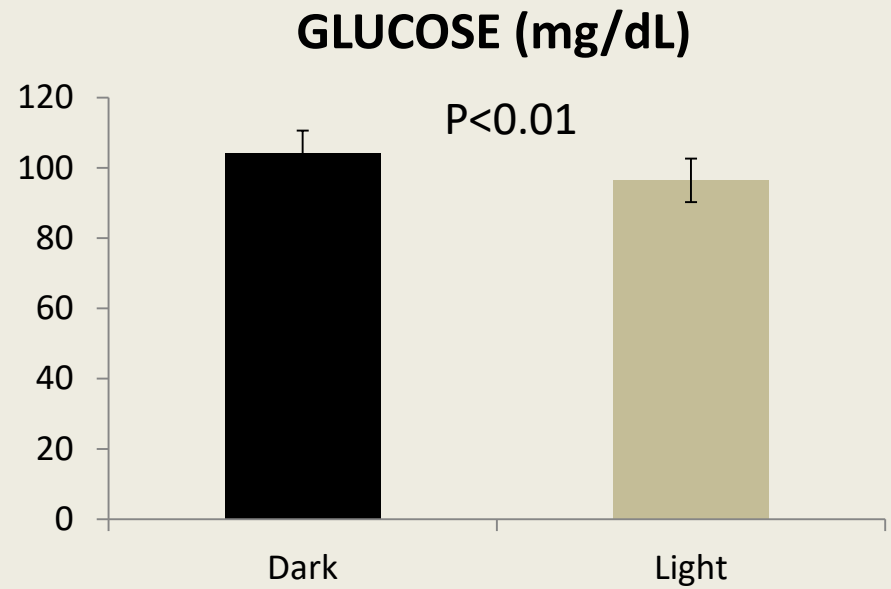
Reduces metabolic rate for the non-efficient animals

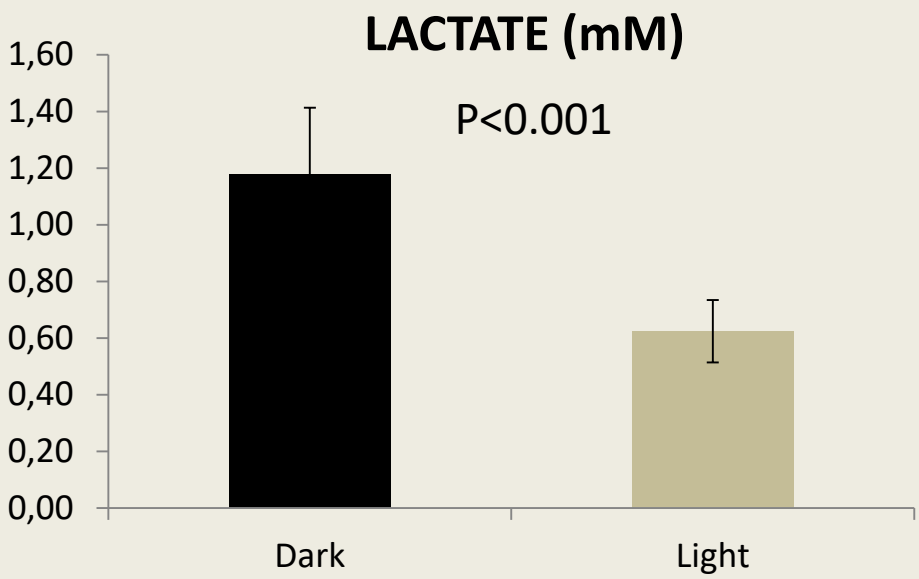


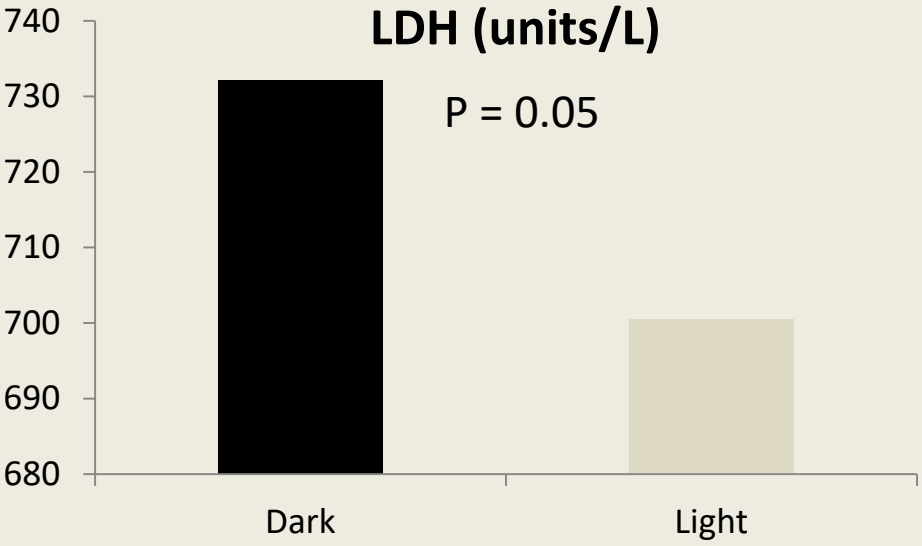


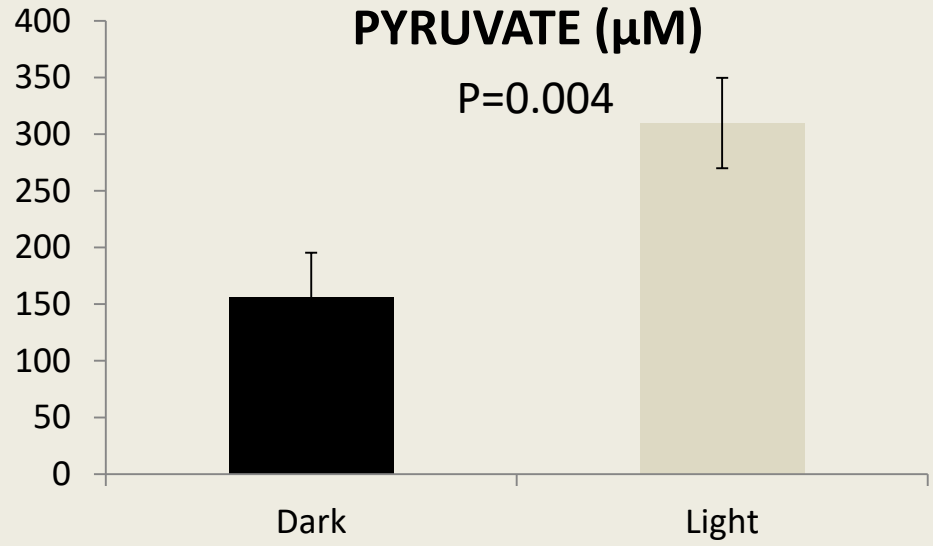


Lower LDH levels for the non-efficient animals

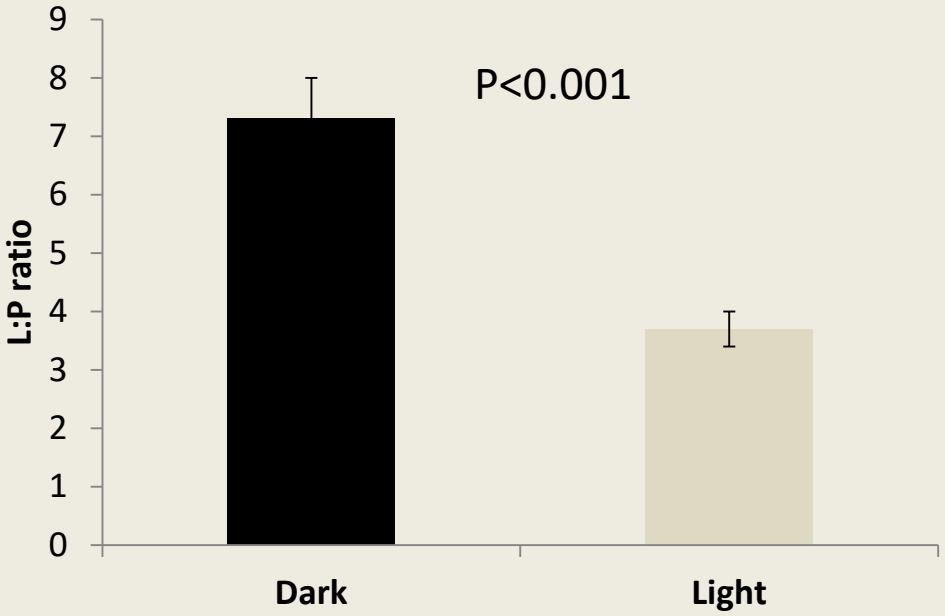




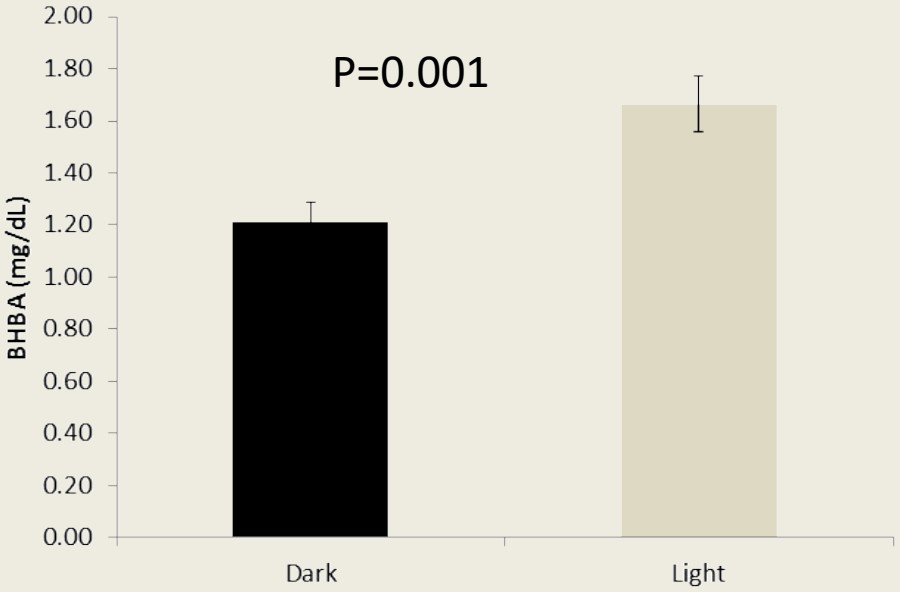




L:P ratio



B-Hydroxibutyrate

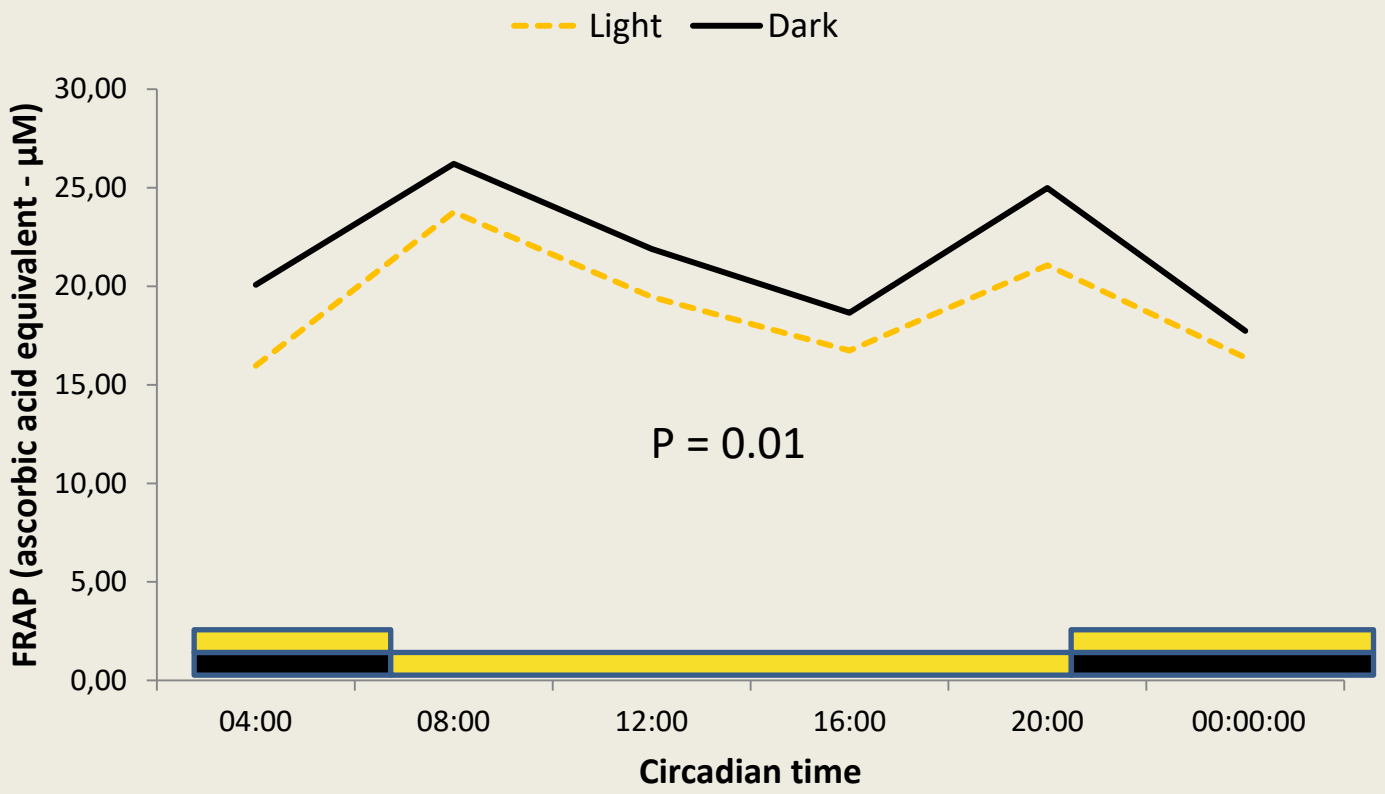


- Lactate/pyruvate ratio may reflect NAD+/NADH ratio
- The production of lactate is a beneficial process because it regenerates NAD+, what ensures that energy production is maintained
- Pyruvate stimulates gluconeogenic genes and decreases mitochondrial & glycolitic genes
- Caloric restriction increases pyruvate and decreases lactate levels

A decline in plasma redox state in non-efficient animals

Wavelength: 488nm, **0.0007nm**

Intensity: 256 lux, **0.001 lux**



Critical values: **λ<460 nm, intensity > 50 lux**

Summary

- **<u>Health</u>: Low plasma redox state in young calves predicts future BRD episodes 2-3 months ahead.**

- **<u>Metabolism</u>: Non-efficient calves have reduces metabolic rate/ redox state.**

- **Controlling plasma redox state may thus be a strategy to control health and metabolism.**

- **Nutrition engineering may be a desired approach.**

Newe Ya’ar Team

Thank you to:

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Thanks for your attention