

Effects of rumen protected dry grape extract supply on milk performance, body temperature, and breathing behavior of Simmental cows during heat stress.

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Background



- ↑ Rectal temp.
- ↑ Respiration rate
- ↓ Milk yield
- ↓ Feed intake
- ↓ *Milk quality*



JOURNAL ARTICLE

Physiological impact of amino acids during heat stress in ruminants

Juan J Lóor ✉, Vincenzo Lopreiato, Valentino Palombo, Mariasilvia D'Andrea

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Heat stress has a huge number of acute or chronic effects which can persist life-long (Bernabucci et al., 2014; Polsky and von Keyserlingk, 2017; West, 2003).

Common effects of HS include reduced DMI, decreased milk and component yield, compromised reproduction, increased standing time, increased respiration rate and body temperature, increased basal metabolism (Beede and Collier, 1986; Hahn, 1999; Rhoads et al., 2009),

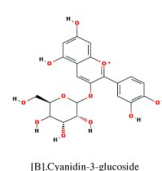
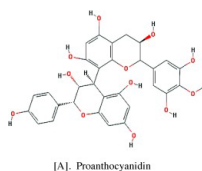
Major actions can be undertaken:

- Acting on the barn micro-environment and consequently on the animals' health, welfare and behavior.
- Identification of more tolerant animals (long term action).

Nutrition Management of Heat Stress?

Is there a room for feed additives?

Background



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Supplementing young cattle with a rumen-protected grape extract around vaccination increases humoral response and antioxidant defenses

Paul Engler^{a,b,1,*}, Clémence Desguerets^{a,1}, Mohamed El Amine Benarbia^{a,b}, Yassine Mallem^c

✓ Let's talk about Polyphenols

Extensive studies reported the intricate relationship between polyphenols' antioxidant properties, anti-inflammatory effect and their link with immunomodulation in different animal species ([Ding, Jiang & Fang, 2018](#); [Mir & Agrewala, 2008](#); [Shakoor et al., 2021](#)).

✓ On Heat Stressed cows

Increased DMI, milk yield, and 4% FCM production, lowered the proportion of time with VT >39°C, improved welfare indices, and enriched the AT proteome with Nrf2-oxidative stress response.



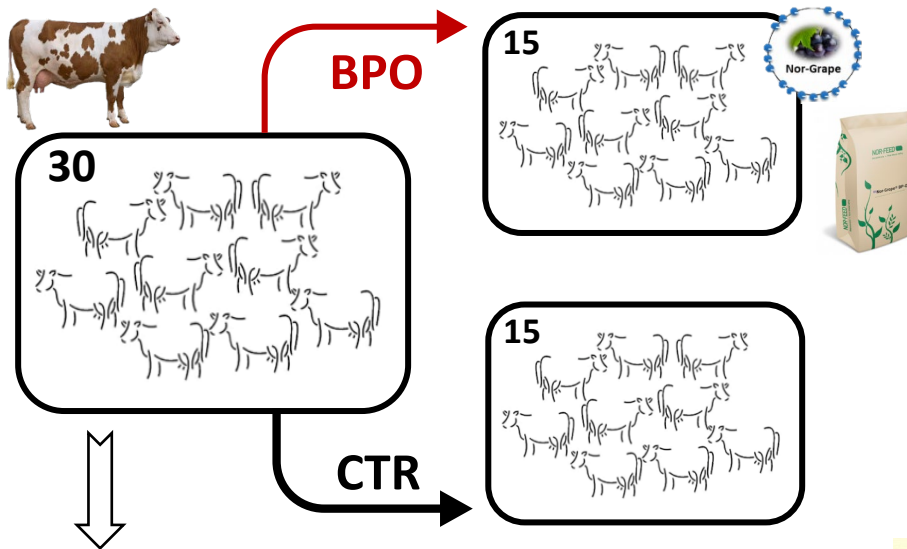
Nor-Grape®BP-0

OUR AIM

Evaluate the effects of rumen protected dry grape extract (NorGrape® BPO) supply (rich in water-soluble polyphenols) on milk performance, rectal temperature (RT), and panting response of mid-lactating Simmental cows during heat-stress.

Materials & Methods

Thirty mid-lactating Simmental cows were blocked by DIM (172 ± 60 d), parity (2.60 ± 1.80), and MY (27.5 ± 7.5 kg/d) and randomly enrolled in 2 groups:



Each cow received 470 mg/d of Nor-Grape® BP-O mixed with corn meal and top-dressed onto TMR in the morning, once a day.

Each cow received only the corn meal carrier top-dressed onto TMR in the morning, once a day.



Hay-based Tmr (55% Dm):
Kg/Head/Day
GRASS HAY: 6.5 - Alfalfa Hay: 6
Corn Meal: 6 - Flaked Corn: 2.2 Concentrate
(33% Cp): 5.6 - Molasses: 1 Fat
Supplementation: 0.3
Minerals And Vitamins: 0.5

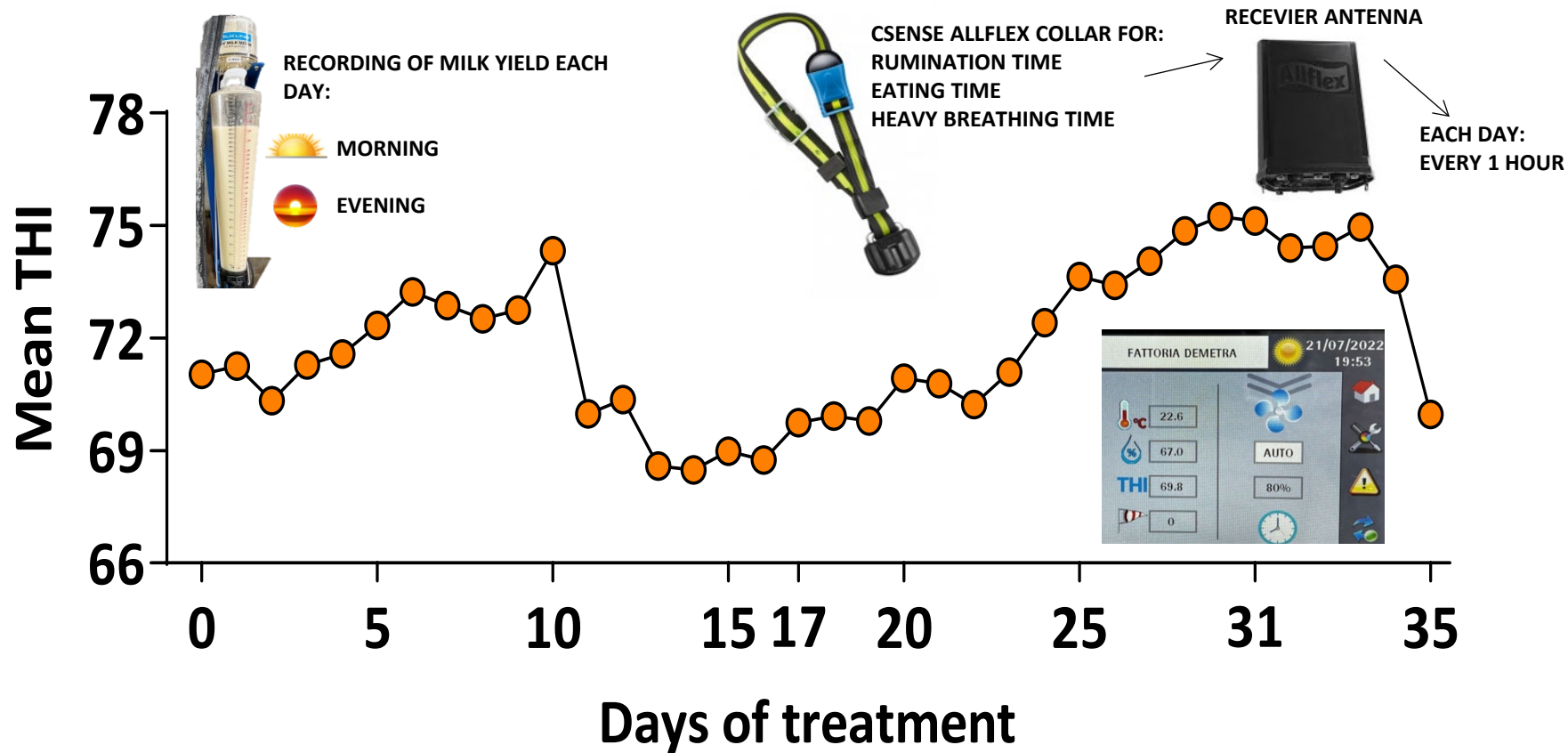


TMR delivered
in the morning
around 6 AM
and once daily

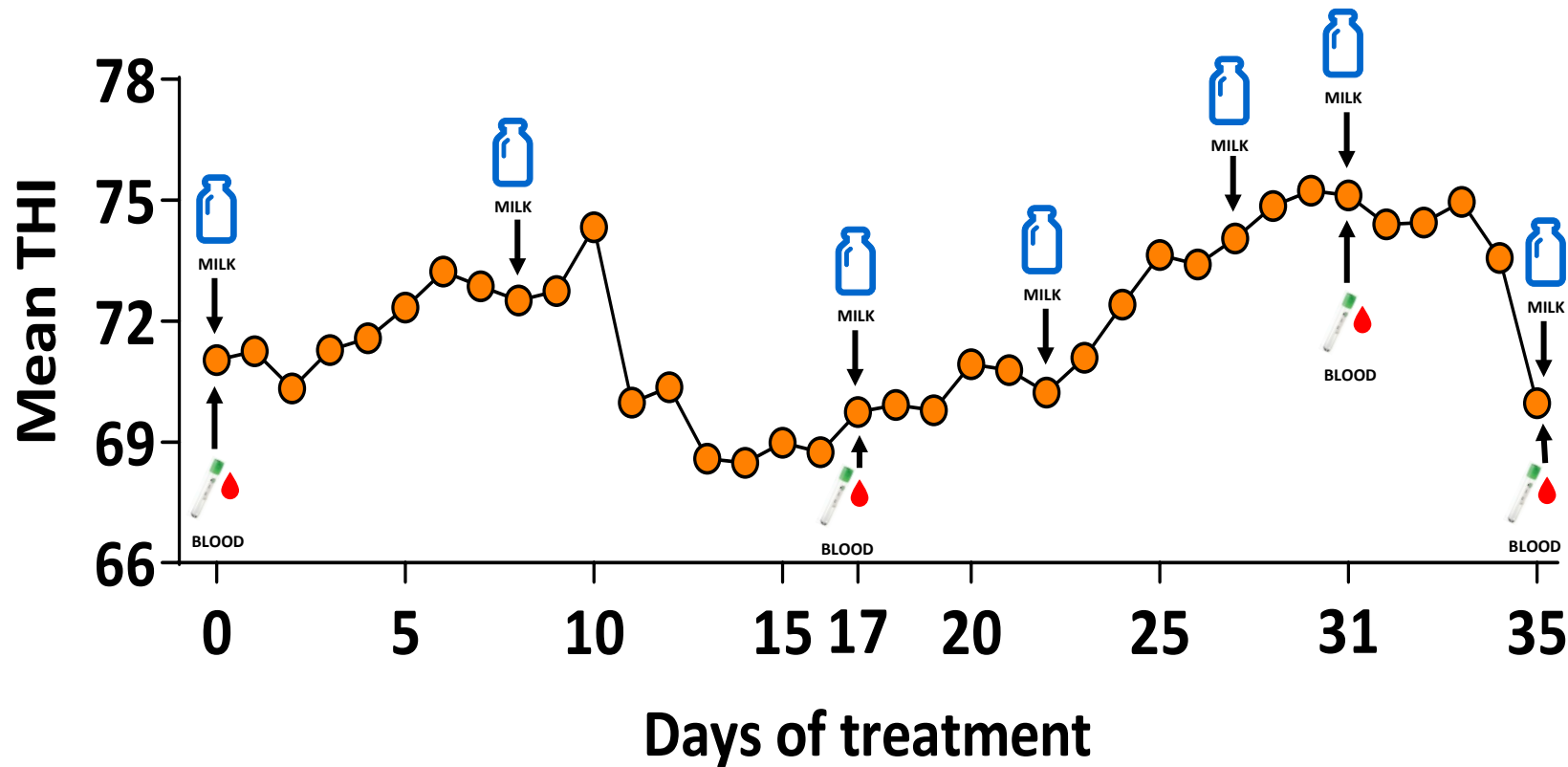


Cows were milked
twice daily at 5 AM
and 5 PM in an 8-
herringbone
milking parlour

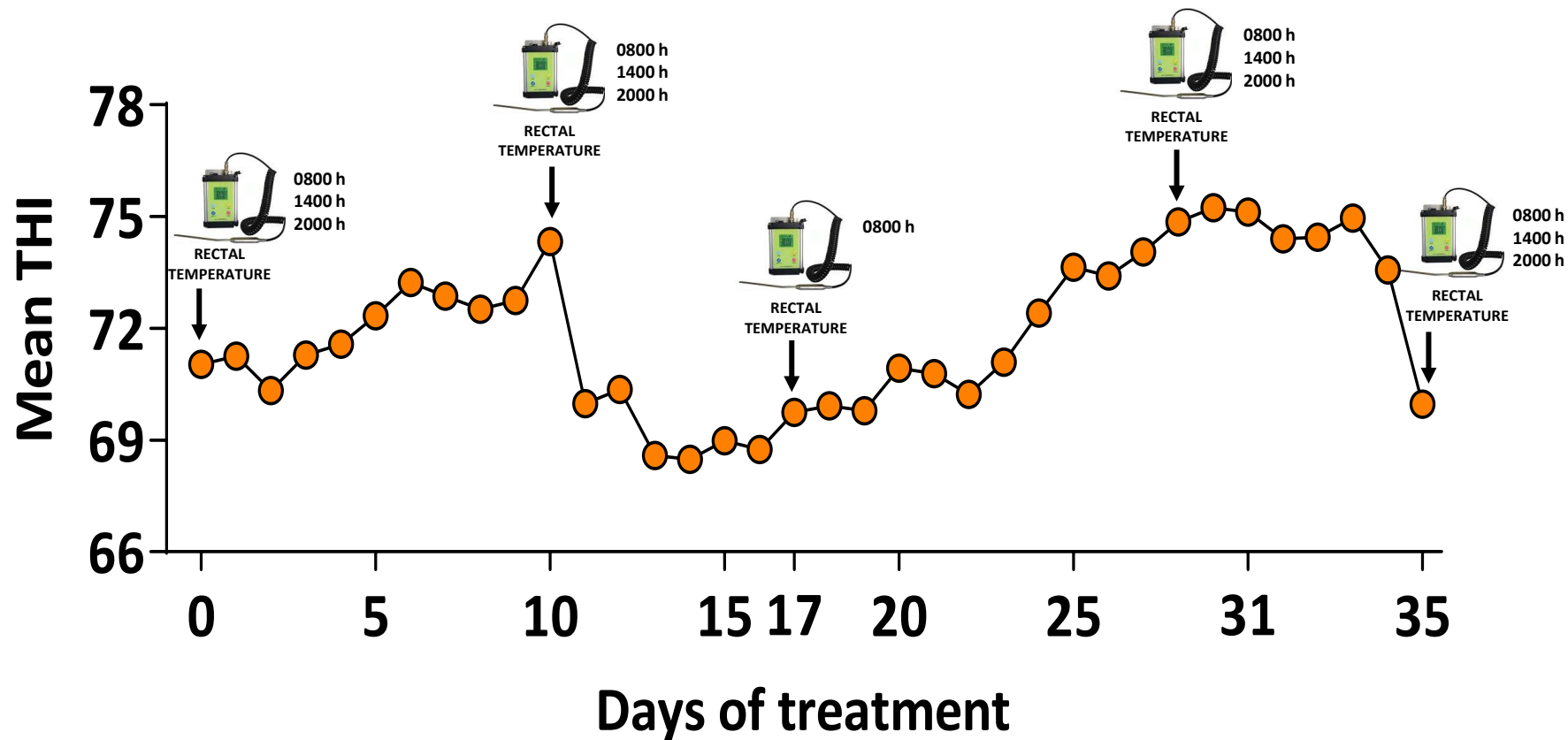
Daily Recordings



Sampling



Measurements



Statistical Analysis

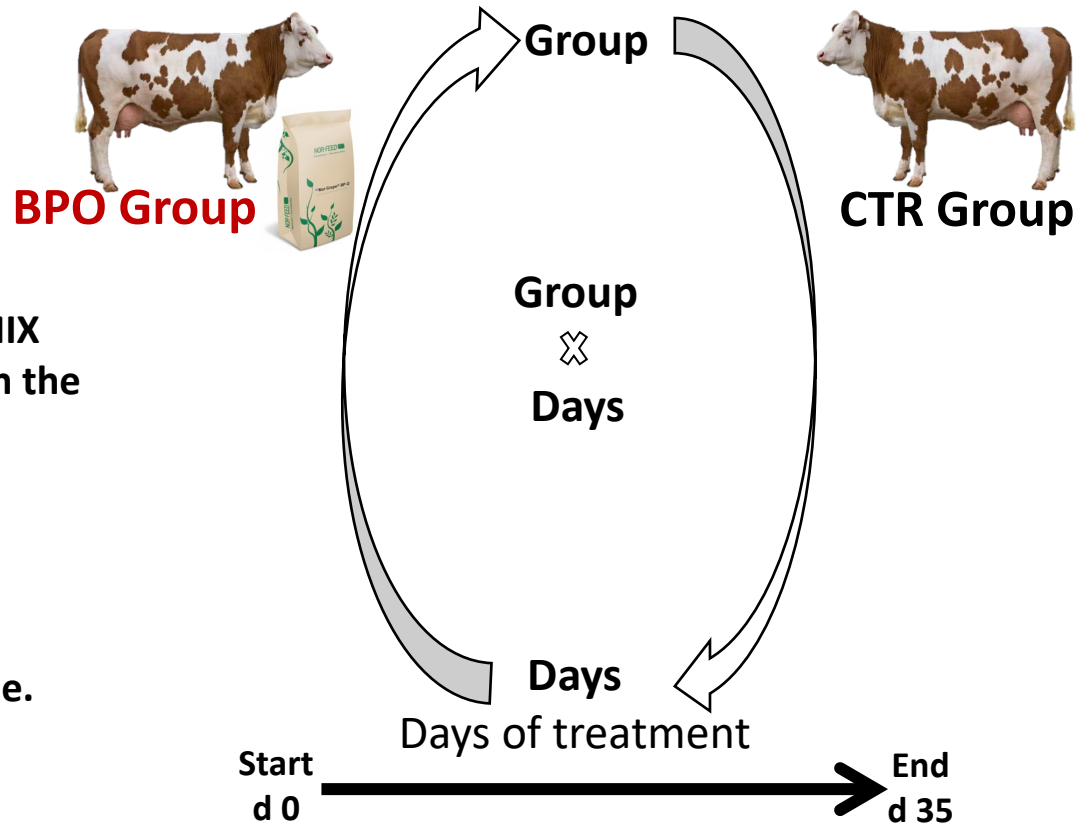


Variables non-normally distributed were $\log_{10}$ transformed.

Data were analyzed using PROC GLIMMIX of SAS (SAS Institute Inc., Cary, NC) with the statement for repeated measures. The log-transformed data were back-transformed.

Covariance structure: the one with the lowest AICC's value for each variable.

Differences: Significant at $P \leq 0.05$.



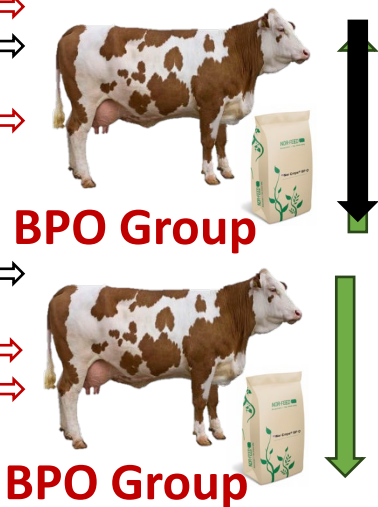
Results: Milk Performance

Milk Performance of mid-lactating Simmental cows during a natural heat stress condition and fed diets supplemented or not with rumen-protected dry grape extract.

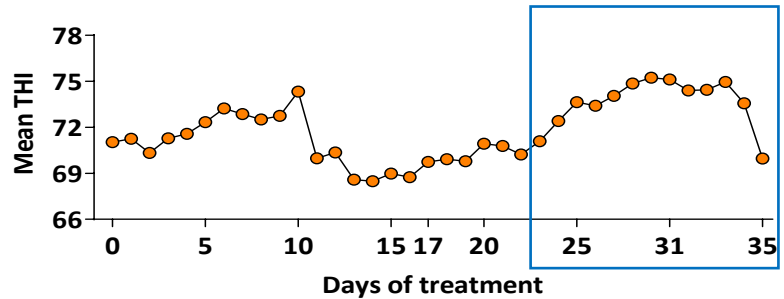
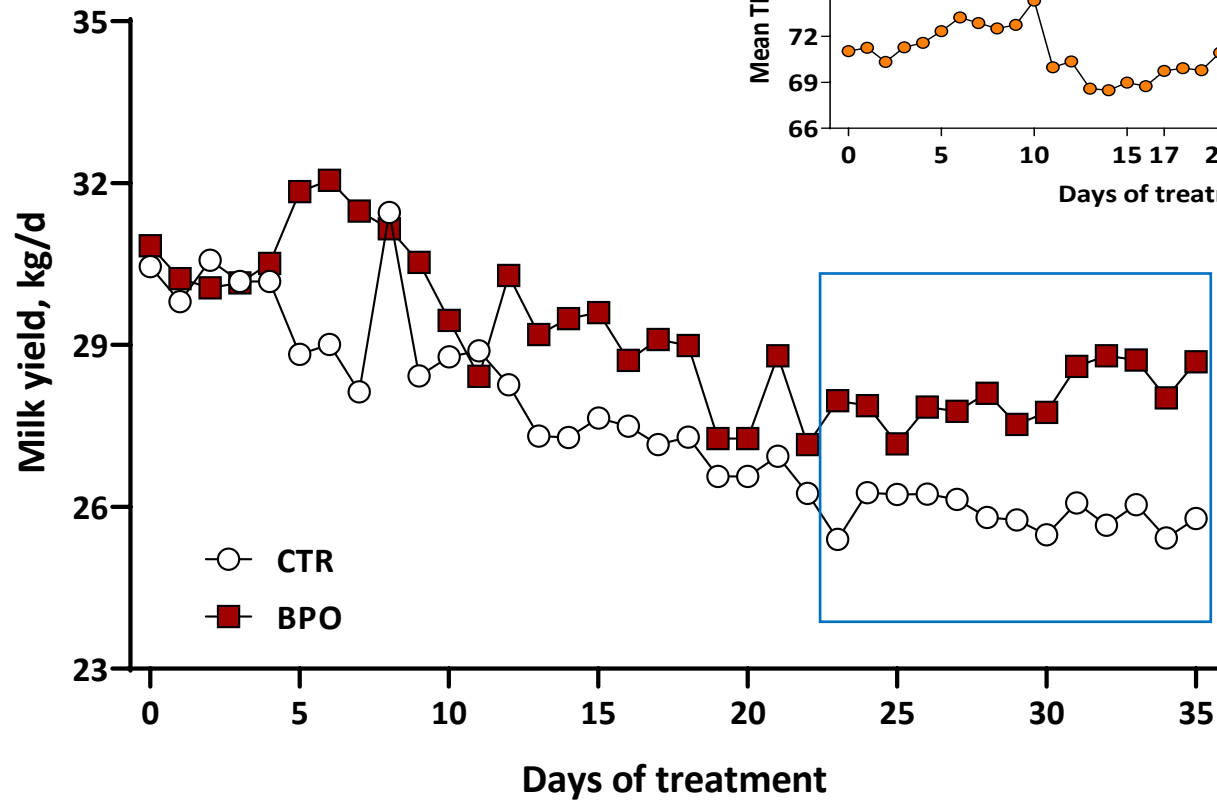
Item	Group		SEM*	P-value		
	CTR	BPO		Group	Time	Group x Time
Milk yield, kg/d	27.38	29.22	1.63	< 0.01	0.18	0.88
Fat corrected milk 4%, kg/d	28.43	30.14	1.58	< 0.01	0.57	0.85
Energy corrected milk, kg/d	28.81	30.36	1.82	< 0.01	0.44	0.91
Fat, %	3.85	3.78	0.16	0.38	0.03	0.37
Fat, kg	1.01	1.09	0.06	0.01	0.84	0.49
Protein, %	3.43	3.36	0.08	0.05	0.78	0.83
Protein, kg	0.91	0.97	0.06	0.02	0.34	0.92
Lactose, %	4.63	4.69	0.07	0.06	0.08	0.92
Casein, %	2.68	2.65	0.06	0.23	0.05	0.90
Urea, mg/dL	29.96	30.69	1.51	0.29	< 0.01	0.64
Total solid, %	12.94	12.8	0.22	0.15	0.45	0.87
SNF, %	9.14	9.02	0.11	0.01	0.33	0.87
Citric Acid, %	0.13	0.12	0.11	0.33	0.13	0.87
Free fatty acids, %	0.67	0.74	0.06	0.03	< 0.01	0.57
Somatic cells count, x 10 ³ cells/mL	112.36	87.85	27.03	0.05	0.15	0.49

* Greatest standard error of the mean.

¹ Simmental cows fed a control diet (CTR) or fed a control diet supplemented with rumen-protected dry grape extract at 470 mg/head/day (NG-BPO)



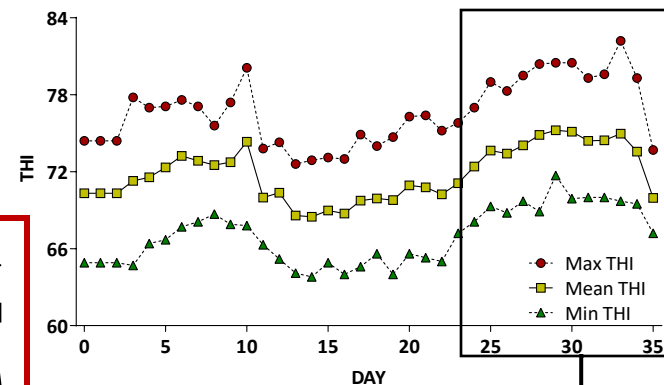
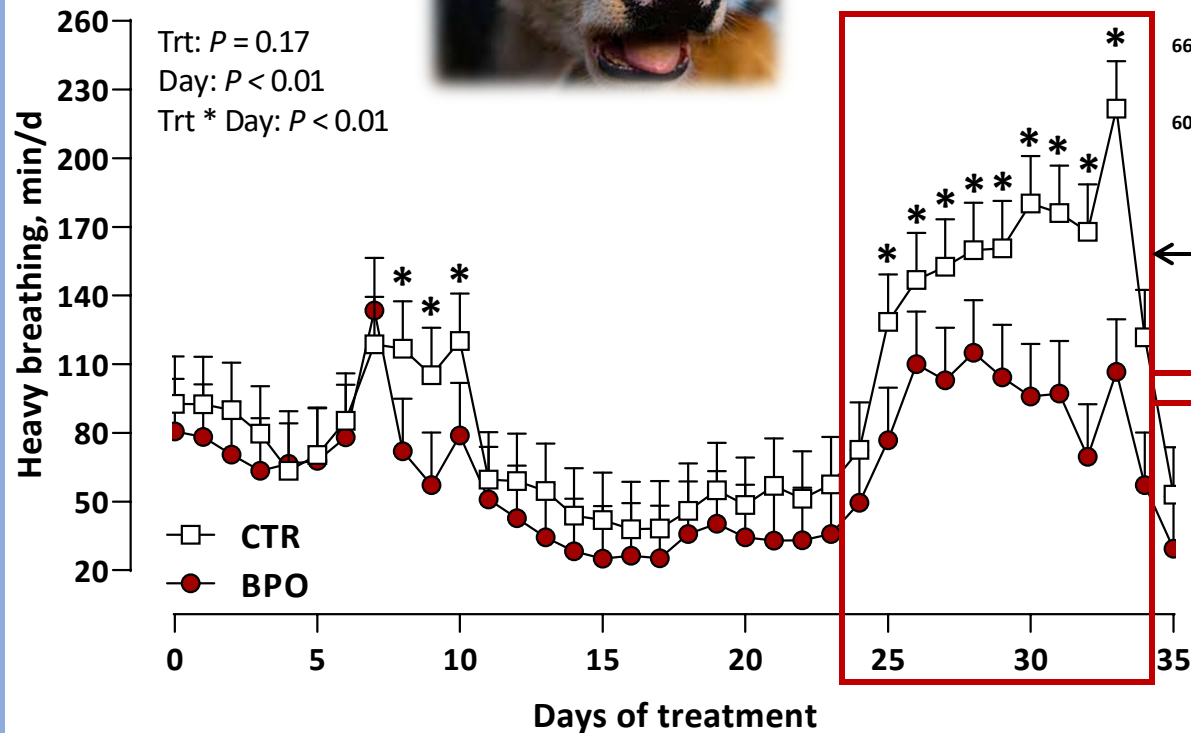
Results: Milk Yield



BPO Group

ON AVERAGE BPO COWS PRODUCED
+2.20 KG/DAY OF MILK IN THE 12 DAYS OF
HEAT LOAD AFTER 3 WEEKS OF TREATMENT

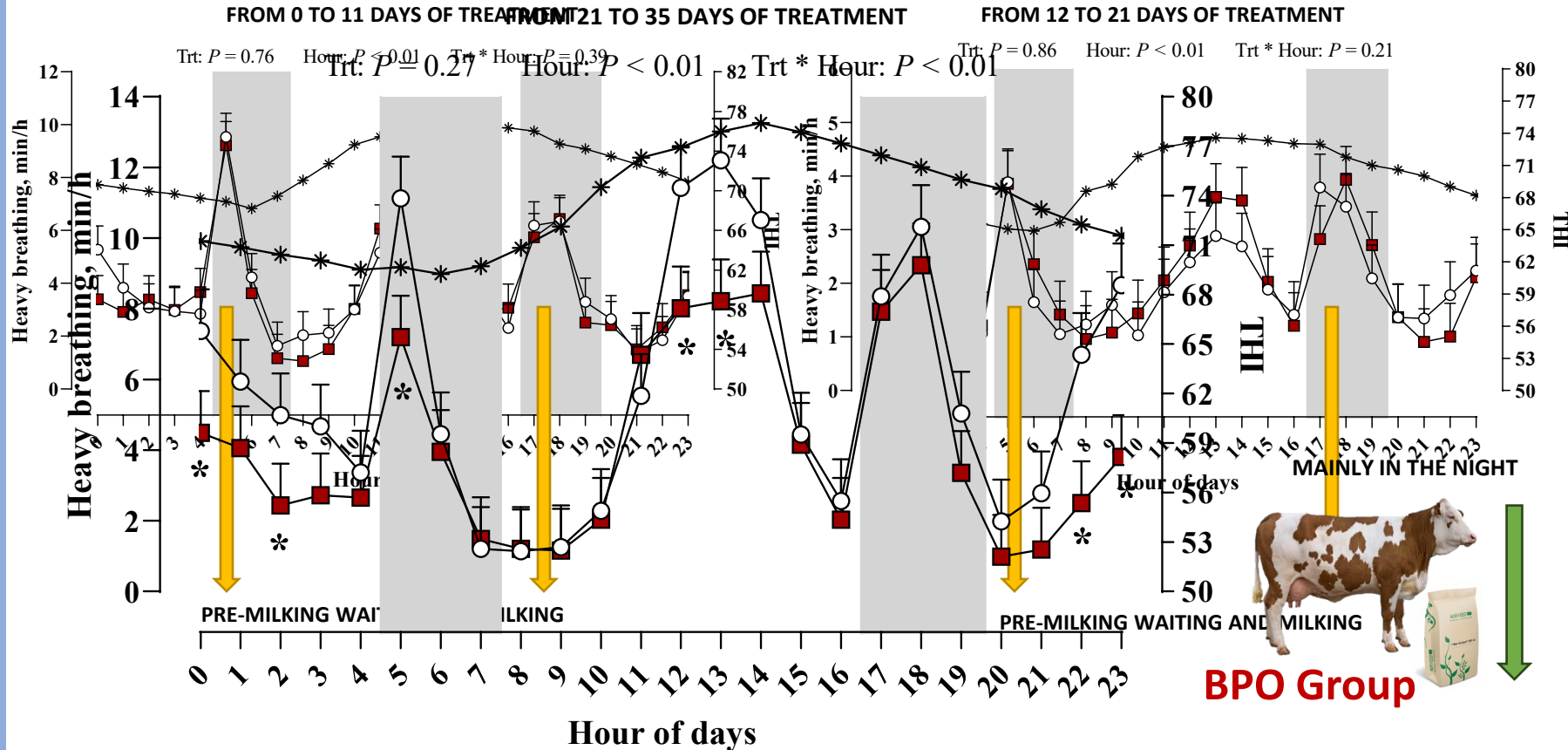
Results: Behavior



BPO Group

ON AVERAGE BPO COWS HAD -70 MIN/DAY OF HEAVY BREATHING

Results: Panting



Results: Rumination

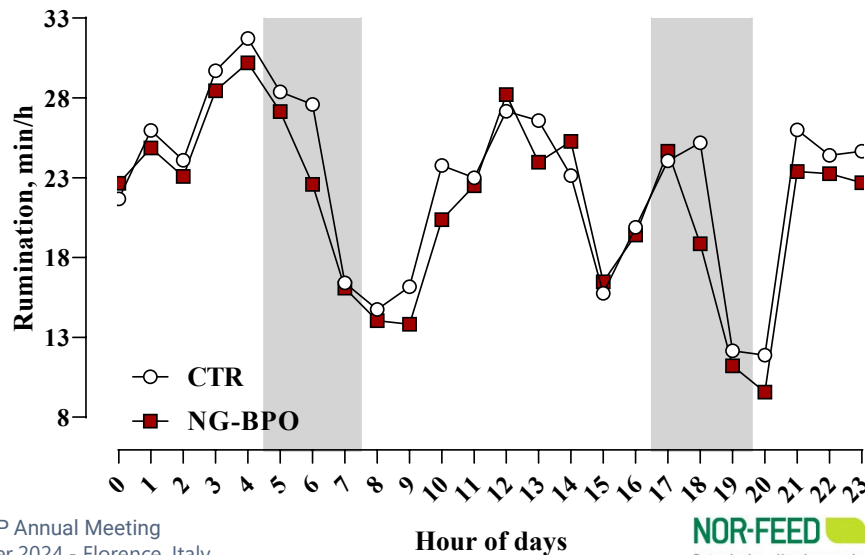
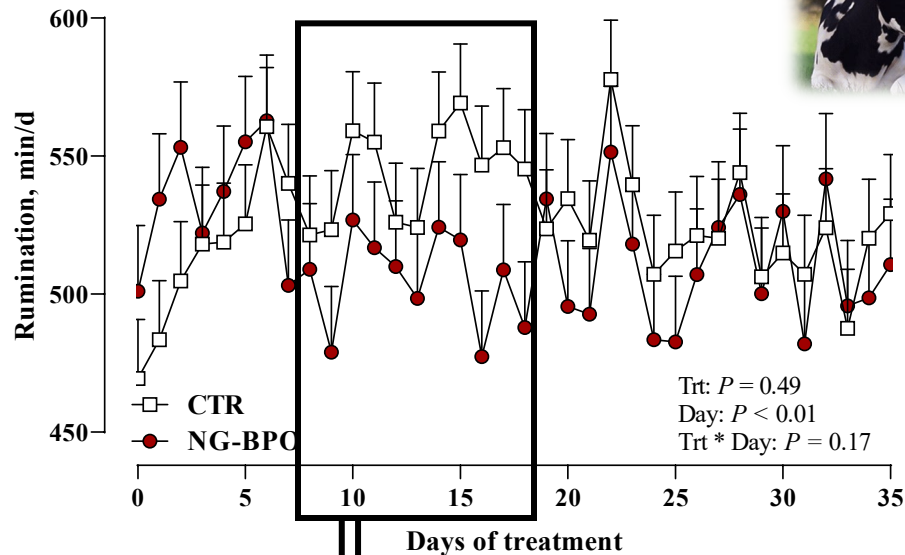


BPO Group



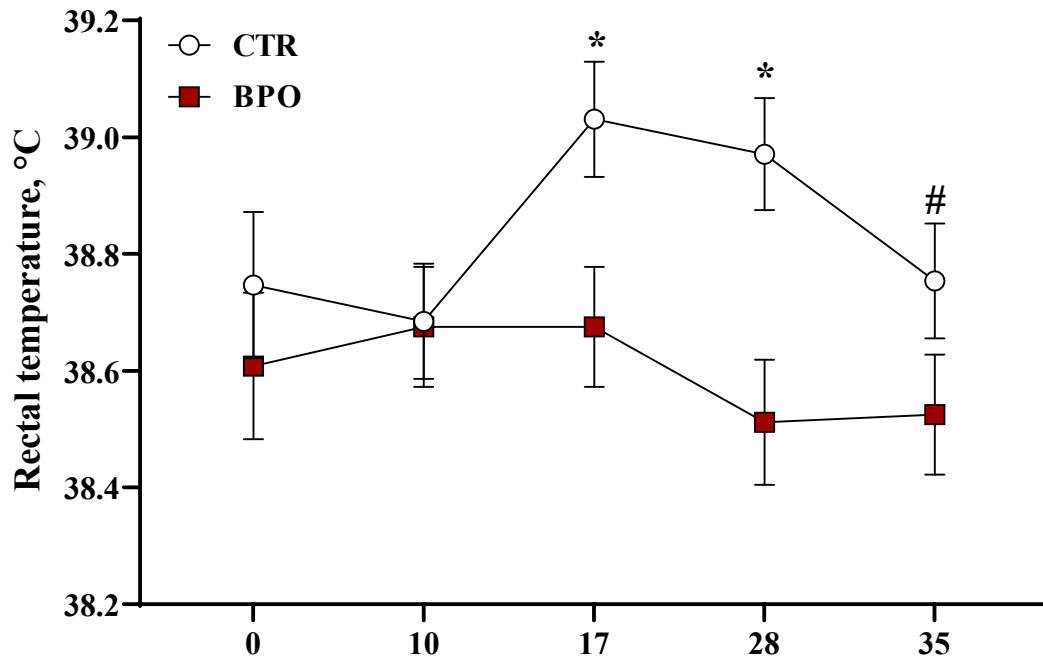
WHEN COWS EXIT FROM MILKING PARLOUR AND FOR THE NEXT 3 HOURS.

THIS MEANS THAT SPEND MORE TIME EATING AND MOVING AROUND (DRINKING MORE?)



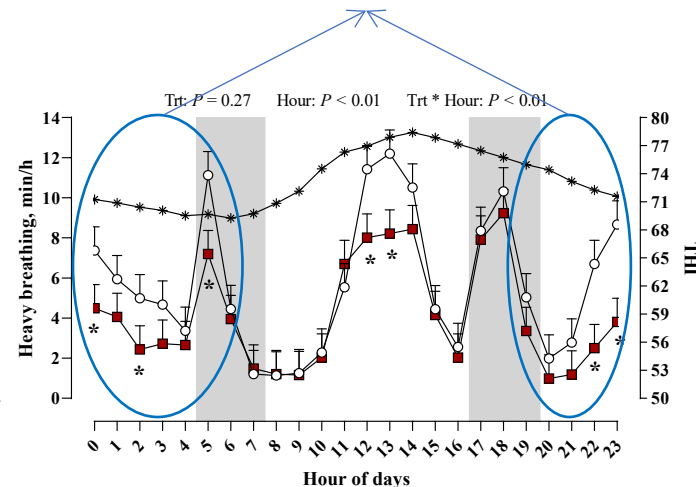
Results: Body Temperature

Morning 08:00 h



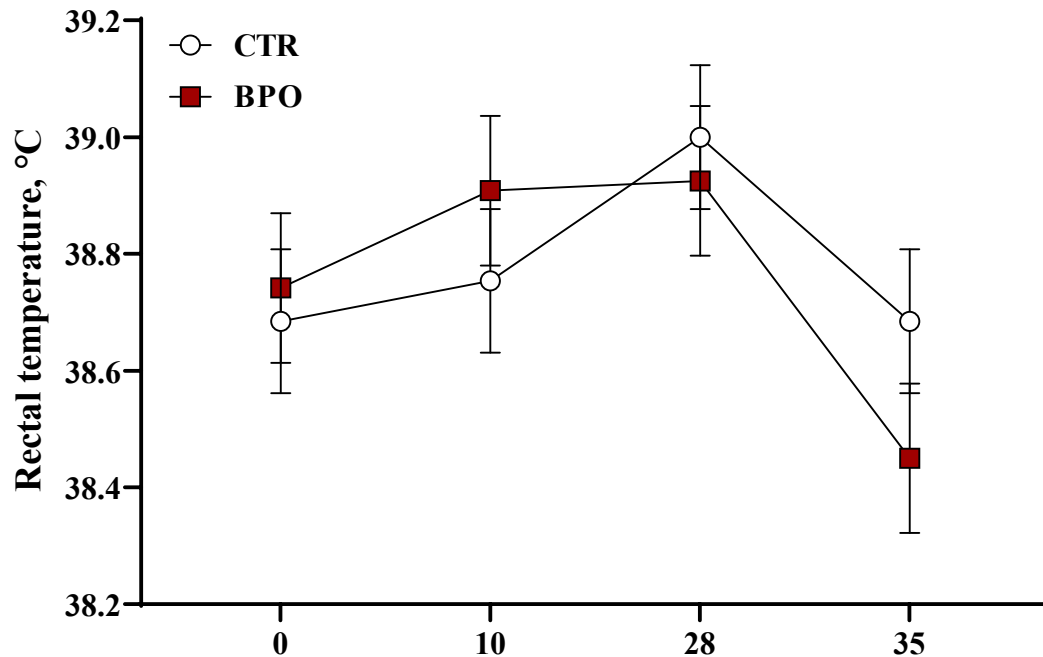
BPO Group

THE LOWER RECTAL TEMPERATURE IN THE MORNING COULD BE SUPPORTED BY AN AVERAGE OF 7 HOURS IN THE NIGHT WITH LOWER PANTING



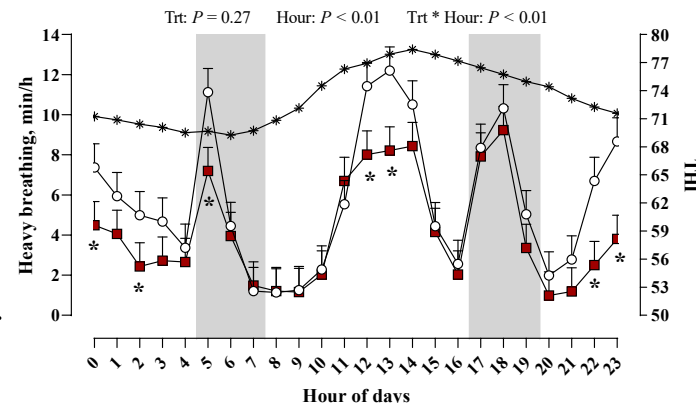
Results: Body Temperature

Afternoon 14:00 h



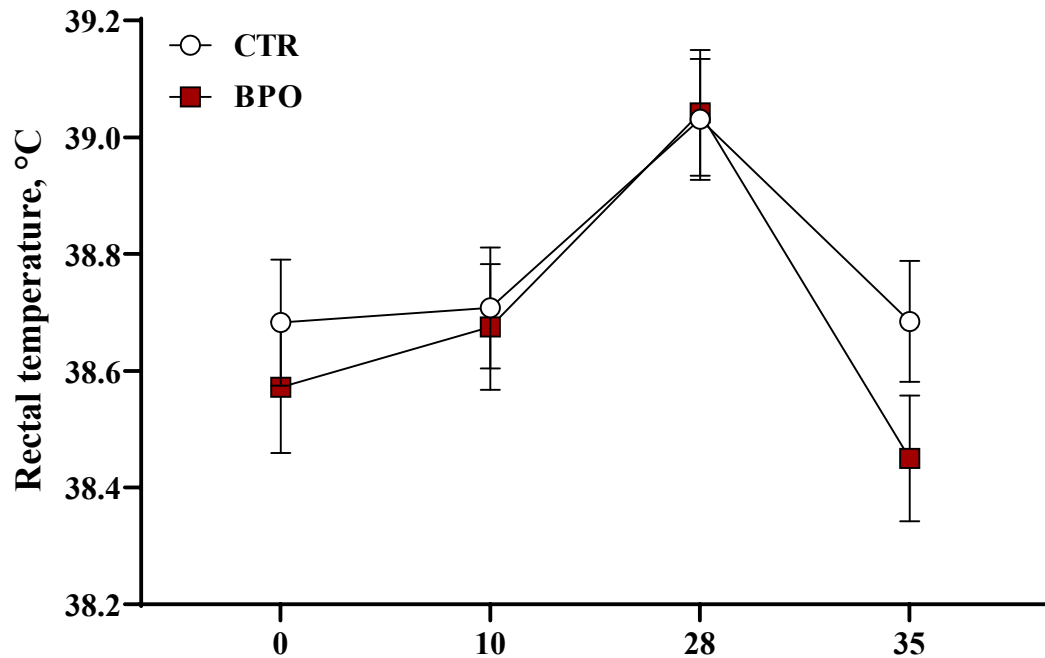
BPO Group

DURING THE DAY BOTH GROUPS MARKED INCREASED THE PANTING BEHAVIOR AND EVEN THOUGH BPO COWS HAD LESS TIME SPENT FOR IT, THE LACK OF DIFFERENCE IN RT COULD BE ASCRIBED AT THE VERY SHORT TIME AT LOWER PANTING TIME



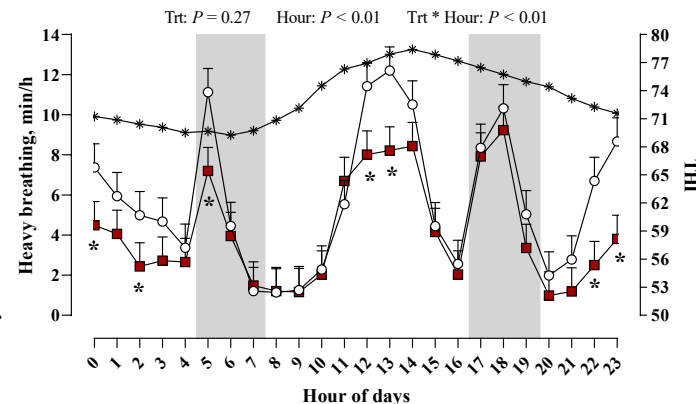
Results: Body Temperature

Evening 20:00 h

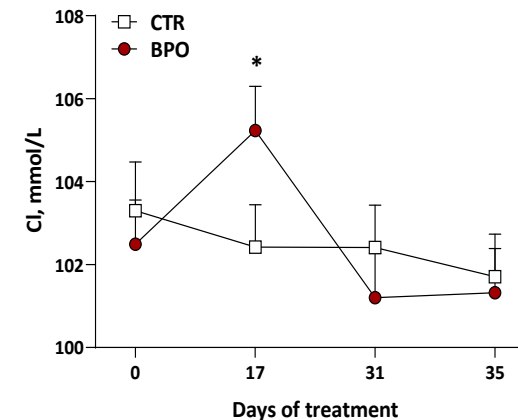
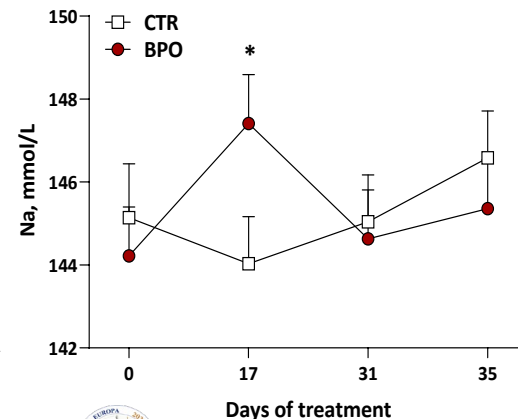
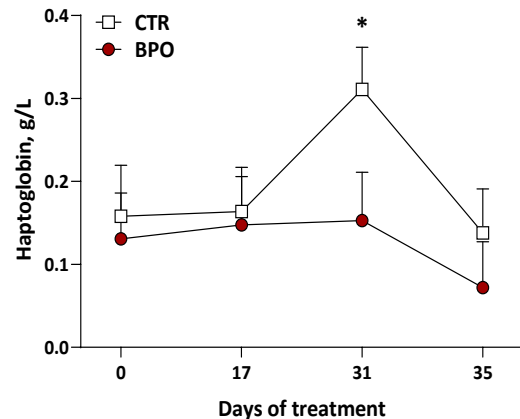
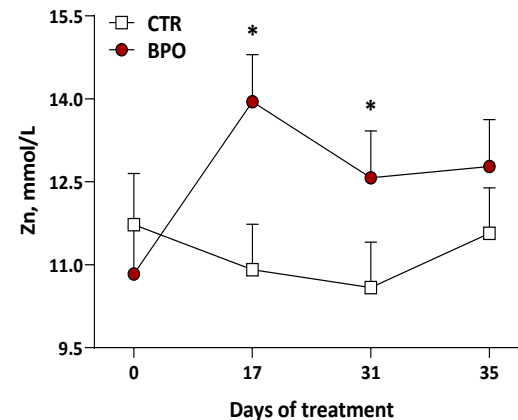
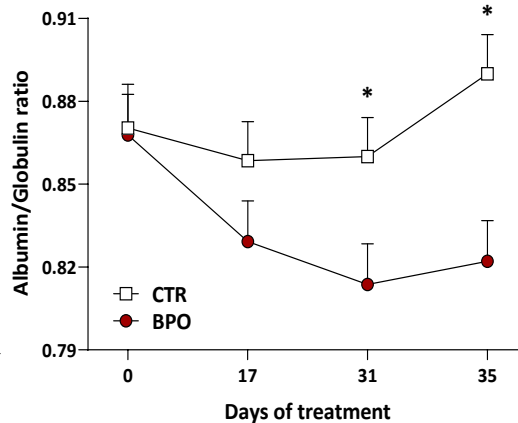
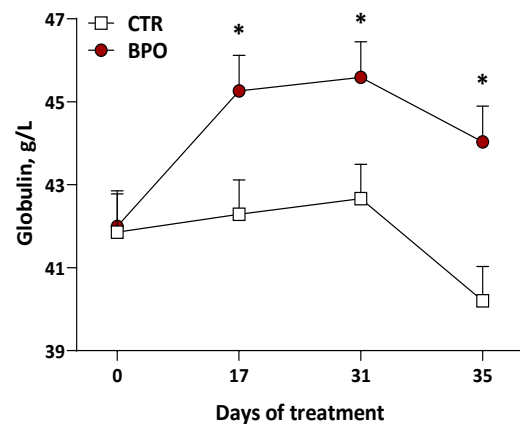


BPO Group

DURING THE DAY BOTH GROUPS MARKED INCREASED THE PANTING BEHAVIOR AND EVEN THOUGH BPO COWS HAD LESS TIME SPENT FOR IT, THE LACK OF DIFFERENCE IN RT COULD BE ASCRIBED AT THE VERY SHORT TIME AT LOWER PANTING TIME



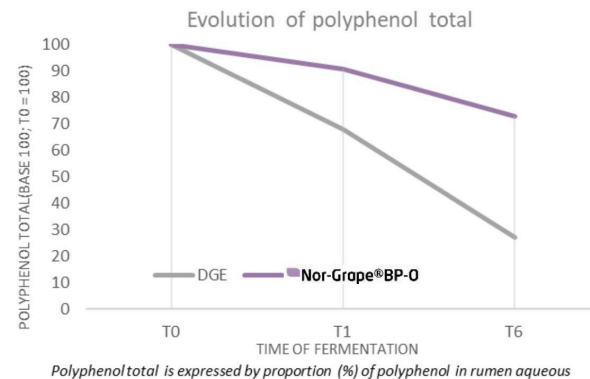
Results: Plasma Biomarkers



Final Consideration and take-home message

Taken together, a small dose of rumen protected dry grape extract rich in water-soluble polyphenols (mostly proanthocyanidins) was able to:

- Keep up the milk production with greater fat and protein output in terms of kg/d, during the period of maximum heat load, considering a THI going above to 72;
- Better modulate thermoregulation, where cows supplemented with Nor-Grape BP-O had an overall lower body temperature when THI was going to increase.
- This result is further corroborated by the breathing behavior of cows, where BPO cows had a relevant and clear lower heavy breathing.
- better allocation of energy for milk production and for the maintenance of thermoregulation??



Increase the humoral immune activity.

Reduce the inflammatory response especially during the hottest period (from 25 to 35 d of treatment) supported by the lower plasma haptoglobin and greater plasma Zn concentrations.

In addition, supplemental Nor-Grape® positively influenced liver functionality (lower bilirubin and greater PON).

thanks FOR ATTENTION

Graduate Students:
Annalisa Amato
Carmelo Cavallo

Industry Collaborators:
Dr. Paul Henger
Dr. Hoa Bui



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