Castillo C.
Pereira V.
Hernández J.
*Méndez J.**
Vázquez P.
Blanco I.
Vecillas R.
Benedito J.L.

Animal Patholgy Department, Veterinary Faculty of Lugo, Universidad de Santiago de Compostela, Spain.

(*) COREN, SCL. Ourense, Spain.

Comparative study between monensin or *Saccharomyces* supplementation in finishing bull calves: effects on productive and metabolic parameters.

Beneficial production responses have been observed in meat production systems, but little information is available on the effects of *S. cerevisiae* on indicators of animal metabolism, such as blood metabolites.

In addition, many studies have been performed under highly controlled conditions that do not closely reflect the management and nutritional protocols used on commercial feedlot farms; as a result, productive responses seen in such studies may fail to be adequately predictive of productive responses under real conditions.

The AIM of the present study was to evaluate the effects of two dietary supplements, the ionophore antibiotic monensin and a live *S. cerevisiae* culture, on acid-base balance in cattle maintained in a commercial feedlot, during the finishing phase of the production cycle.

Materials and Methods

✓A 77-day feedlot study was conducted using 42 double muscled Belgian Blue steers:

- *The animals were adjusted to their fattening diet using an adaptation diet for 7 weeks (from 16 to 23 weeks of age: the growing period in the Spanish feedlot system)*

✓Three experimental groups: (1) control group (no supplementation, n=10, C), (2) monensin (n=16, MON, Rumensin, Elanco Animal Health, Madrid, Spain), at a concentration of 30 mg/kg concentrate (DM basis), and (3) a live culture of *S. cerevisiae* strain NCYC Sc 47 (n=16, SACC Biosaf Sc 47 (guaranteed yeast cell content >5 x 10^9 colony-forming units (CFU) per g/additive), Eurotec Nutrition, Madrid, Spain) at a dose of 500 mg/kg concentrate (DM basis).

✓ Dietary composition was typical of diets given commercially to feedlot cattle in Spain (Table 1), with barley straw *ad libitum*.

Table 1. Ingredients and chemical composition of the concentrate fed during the present study

Ingredient (%DM)	
Barley	32.9
Corn	27.5
Molasses	3.3
Palm kernel oil	4.0
Palm oil (98% bypass)	1.6
Soybean meal, 44% CP	12.9
Corn gluten feed	14.0
Soybean hulls	1.6
Vitamin/mineral premix[a]	2.2
Chemical composition (%DM)	
CP	15.0
CF	5.0
ADF	6.8
NDF	19.3
EE[b]	4.1
NFC[c]	56.6
Ash	5.0

[a]Vitamin and mineral premix containing (per kg DM premix): 10000 IU vitamin A, 2000 IU vitamin D, 10 IU vitamin E, 0.4 mg Co, 16 mg Cu, 25 mg Fe, 2 mg I, 110 mg Mn, 0.3 mg Se, and 120 mg Zn.

[b]EE: ether extract content

[c]NFC: non-fibre carbohydrates calculated as 100 – (CP + ash + NDF + EE)

All grains were ground through a hammer mill with the rollers of the mill adjusted to crack the grain coarsely (5-mm diameter). Concentrate ingredients, including the yeast culture, were mixed together, but not pelleted, and offered as a single mixed concentrate feedingstuff.

✓ Blood samples were collected by jugular puncture on days 0 (just after the adaptation period prior to supplementation), 3, 7, 13, 51 and 77 (the last day of the finishing period, prior to slaughter). Measured parameters were venous blood pH, bicarbonate, base excess (BE), pCO_2 and serum L-lactate.

✓ Production parameters were measured at the end of the finishing period, and can be considered as useful complementary information associated with supplementation (see Table 2).

✓ Data were subjected to analysis of variance (ANOVA); the model also included the effects of time (T) and treatment (TR), and the TxTR interaction.

No significant differences were observed among groups. Nevertheless, note that the animals that showed the highest concentrate intake and average daily gain (ADG) and reached the highest weight were the non-supplemented animals. Food:gain ratio was lowest (i.e. most efficient) in the monensin group.

Table 2. Effects of supplementation on feedlot performance.

	Groups†			
	C	MON	SACC	SEM
Variable				
Days in test	77	77	77	
Final weight (kg)	420	411	407	2.69
ADG (kg)	1.5	1.48	1.50	0.05
Daily intake (kg/d)	8.1	7.4	7.8	0.15
Feed:gain ratio	5.2	5.0	5.2	0.12

†C = Control (non-supplemented); MON = monensin; SACC = *S. cerevisiae*
‡Standard error of the mean
§Significance level in analysis of variance among groups; NS = not significant (P>0.05)

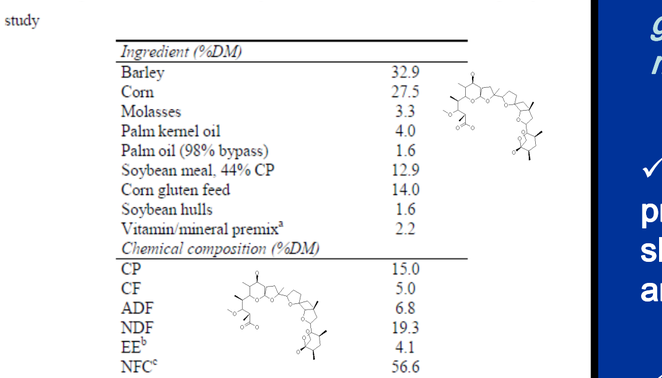

*Figure 1. Mean venous blood pH (± SE) of steers in the control (C; --▲--), monensin-supplemented (MON; —●—) and yeast-supplemented (SACC; —○—) groups. Analysis of variance indicated a significant effect of time (T) (P = 0.001), but not of treatment (TR) (P = 0.111) or T*TR (P = 0.288).*

✓The time course is attributable to the introduction of the fattening diet, although these fluctuations seemed to be less intense in animals on monensin.

✓Nevertheless all groups finished the study with similar values, indicating that non-supplemented animals were able to restore blood pH values to the same level as the supplemented animals.

The time-course of this parameter at the start of the study (until day 13) was the opposite of the blood pH time course, suggesting that pH fluctuations were probably not only attributable to the high-grain diet consumption, but also to pCO_2 variations.

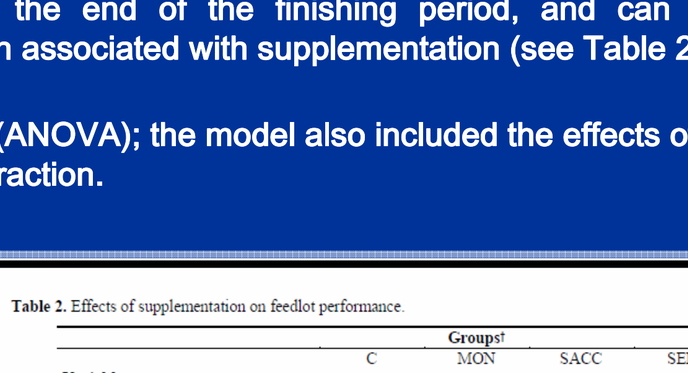

***Figure 2.** Mean venous blood pCO_2 (± SE) of steers in the control (C; --▲--), monensin-supplemented (MON; —●—) and yeast-supplemented (SACC; —○—) groups. Analysis of variance indicated significant effect of time (T) (P = 0.004) and treatment (TR) (P = 0.057), but no significant T*TR interaction (P = 0.288).*

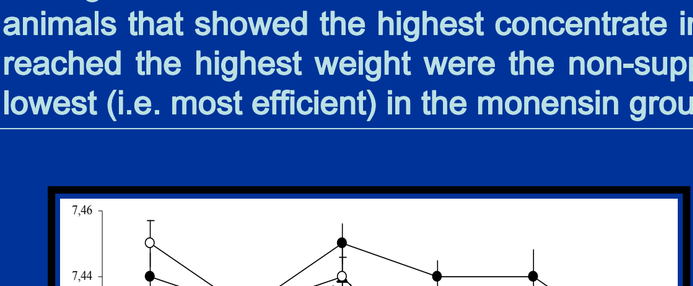

***Figure 3.** Mean blood HCO_3^- (± SE) of steers in the control (C; --▲--), monensin-supplemented (MON; —●—) and yeast-supplemented (SACC; —○—) groups. Analysis of variance indicated a significant effect of time (T) (P = 0.031) and treatment (TR) (P = 0.006) but not of T*TR (P = 0.132).*

✓The time-course observed in C is indicative of a reduction in blood buffers as a compensatory mechanism attributable to ruminal acid absorption (Goad et al., 1998)

✓Marked differences appeared between the two supplements:

- ✓ *Supplementation with MON led to stability in the buffering system, minimizing the fluctuations in blood pH with respect to controls.*

✓ *At some times non-supplemented animals showed higher bicarbonate levels than SACC steers.*

Mean serum L-lactate levels remained stable over time and within physiological ranges (Radostits et al., 2000), without statistically significant differences among groups at any time, suggesting that supplementation did not influence in lactate production.

	Days						P>F‡		
Variable	*0*	*3*	*7*	*13*	*51*	*77*	T	TR	T*TR
BE									
C†	8.20±0.73	7.80±0.86	7.20±1.01	6.40±0.50	4.50±0.67	7.60±1.20			
MON	8.00±0.59	8.37±0.70	8.37±0.32	7.50±0.46	8.00±0.37	7.75±0.52	**0.033**	**0.007**	0.109
SACC	7.25±0.64	6.00±0.84	5.87±.58	5.37±0.73	6.62±0.62	6.00±0.37			
Lactate (mmol/L)									
C	0.456±0.02	0.534±0.04	0.606±0.13	0.520.04±	0.482±0.04	0.573±0.04			
MON	0.536±0.02	0.484±0.04	0.495±0.03	0.49±0.04	0.567±0.04	0.535±0.03	0.924	0.914	0.137
SACC	0.506±0.03	0.542±0.04	0.465±0.03	0.47±0.04	0.546±0.04	0.499±0.03			

Conclusion

Supplementation, especially with monensin, protects the steers against the acidotic trend associated to a high-grain consumption. Given that this ionophore is prohibited in the EU, more *in vivo* research related to industry conditions is needed on possible alternative supplements, such as yeast, with a view to maximizing the economic performance of feedlot systems

More information in: Castillo et al (2006): *Animal Science* 82:653-659