Natural solution to control pathogens on the slaughter line

Food safety is one of the most important and most valued attributes by those who consume animal source foods. With that in mind, industries and the scientific community have been looking for improvements in technologies, nutrition, health and animal management to ensure safe products with no risk to human health.

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In the production of animal source foods, each stage of the production, including processing and slaughter, is an integral part of food safety from the field to the consumer's table. The end quality of the product may be influenced by several factors, such as hygiene and sanitation, which are related to the microbial contamination of carcases.

Although there are many points associated with cleaning and sanitising the environment and employees, the quality of the water used in the slaughter process and pest control, steps considered most critical for carcase contamination, are the initial stages of the slaughter process, such as skinning and evisceration, where the skin and viscera come into contact with the flesh carrying pathogenic micro-organisms.

Meat is an excellent substrate for microbial development, mainly due to its high-water activity (aw) of 0.99 and its low molecular weight components (carbohydrates, lactates and amino acids), thus constituting a potential danger to consumers as they may carry pathogenic micro-organisms, such as salmonella and Escherichia coli.

Thus, all measures that can minimise the microbial load without generating residues in the carcase (from the rearing system to the slaughter) are extremely important for the quality of the end product and food safety.

The use of yeasts as food additives, in addition to assisting the rumen microbiota, reduces contamination by pathogens and strengthens the immune system, contributing to general health and the animal's response to challenges.

Pure yeast product

RumenYeast is a pure yeast from Saccharomyces cerevisiae that goes through the autolysis process in which its internal cellular content overflows, making soluble solids

available by fermentation of the medium. The end product consists of vitamins, peptides, free amino acids and functional carbohydrates, such as MOS and β-glucans.

β-glucans, in addition to providing immunomodulation of the innate immune system by stimulating the production of cytokines that trigger an increase in phagocytic cells, are also capable of binding to different toxins.

In addition to these benefits, there is also the effect of agglutination of pathogenic bacteria by MOS (mananoligosaccharides), which provides better integrity to the villi, i.e., intestinal permeability is reduced, thus providing a protective barrier against bacteria and mycotoxins into the bloodstream.

RumenYeast offers the perfect nutrition for the ruminal microbiota because, in addition to promoting intestinal health and strengthening the immune system, it acts by maintaining the pH and stimulating cellulolytic bacteria, thus improving rumen conditions.

Trial results

A study carried out at the Animal Production Center (NUPRAN) at UNICENTRO, Guarapuava, Paraná, by the team of Prof. Dr Mikael Neumann and Prof. Dr Heloísa Bertagnon, evaluated the effect of RumenYeast on the reduction of total coliforms and Escherichia coli in faeces and bovine carcases at the time of slaughter after evisceration.

The supplementation of RumenYeast in the diets reduced the faecal excretion of total coliforms and Escherichia coli, which reduced contamination of these agents in the carcase after evisceration. (Tables 1 and 2). The nutrients contained in yeast-based additives are used to

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Table 1. Effects of supplementation with RumenYeast on the counts of E. coli and total coliforms in the faecal microbiota (log CFU/g of faeces) of feedlot cattle.

	Treatments	29 days	90 days	SEM	P time	P treatment x time
E. coli	Control	3.29 ^{aA}	3.31 ^{aA}	0.08	0.17	0.0001
	RumenYeast 4g	3.23 ^{aA}	3.21 ^{aAB}	0.11	0.08	
	RumenYeast 7g	3.27 ^{aA}	2.56 ^{bB}	0.15	0.02	
	P treatment	**0.89**	**0.0008**			
Total coliforms	Control	5.76 ^{aA}	5.51 ^{bA}	0.05	0.006	0.001
	RumenYeast 4g	5.77 ^{aA}	5.58 ^{bA}	0.07	0.05	
	RumenYeast 7g	5.76 ^{aA}	5.23 ^{bB}	0.08	0.03	
	P treatment	**0.91**	**0.008**			

* Different lower-case letters in the same row indicate statistical difference in time interaction, Test T, different upper-case letters in the same column indicate statistical difference, for treatment interaction, P<0.05%. SEM: standard error of mean.

Table 2. Effect of supplementation with RumenYeast on E. coli, total coliforms and mesophilic counts on the carcase surface (log10/cm²) of feedlot cattle.

	Treatments	105 days	SEM	P value
E. coli	Control	0.55 ^{A}	0.16	0.06
	RumenYeast 4g	0.20 ^{A}	0.08	
	RumenYeast 7g	0.20 ^{A}	0.06	
Total coliforms	Control	0.76 ^{A}	0.2	0.10
	RumenYeast 4g	0.31 ^{A}	0.17	
	RumenYeast 7g	0.25 ^{A}	0.16	
Mesophiles	Control	1.60 ^{A}	0.12	0.05
	RumenYeast 4g	1.20 ^{B}	0.13	
	RumenYeast 7g	1.24 ^{B}	0.11	

*Different upper-case letters in the same column indicate statistical difference between the groups, Tukey's test, P<0.05. SEM: standard error of mean.

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multiply ruminal micro-organisms, increasing the fermentation of the diet; the other ones are absorbed (phagocytes), stimulating a more efficient immune response through leukocytes (white blood cells) to fight against infectious agents.

In addition to improving the response of the animals' immune system, they can promote the growth of beneficial bacteria and control the pathogenic population, as shown in another study conducted with lambs at Universidade Autónoma de Baja California, Mexico, by the team of Prof. Dr Alejandro Plascencia Jorquera.

The lambs were divided into four treatments:

- Control.
- RumenYeast (3g/head/day).
- Live yeast (live Saccharomyces cerevisiae 3g/head/day).
- Live yeast + RumenYeast (1.5g/head/day live yeast +1.5g/head/day RumenYeast).

The test was aimed at evaluating the effect of yeast-based additives on reducing the count of ruminal and faecal bacteria.

The association of RumenYeast with live yeast reduced the count of Clostridium aminophilum and ruminal E. coli O 157: H7.

The reduction of some ammonia-producing ruminal bacteria, such as Clostridium aminophilum and Clostridium sticklanii, can have an important effect in improving nitrogen retention, as was observed in the results complementary to this study, which there was a reduction of rumen N-NH3 with supplementation of RumenYeast, as well as with the association of RumenYeast with live yeast. The E. coli O 157: H7 count in faeces was reduced with the addition of RumenYeast in the diet, and the same effect was observed for the association of RumenYeast with live yeast (Table 3). The statistical reduction in the number of CFU of E. coli O157:H7 in the faeces of lambs, as evidenced by the supplementation of RumenYeast in the diet, is extremely important for the control of this bacterium and for the contamination it can cause in the animal carcase.

	Treatments				Structured Equation Modelling (SEM)
	Control	3g Rumen Yeast	3g Live yeast	1.5 LY + 1.5g Rumen Yeast	
Ruminal bacteria (log_{10}/mL)					
Clostridium aminophilum	8.966 [a]	9.038 [a]	8.884 [a]	8.570 [b]	0.05
Clostridium sticklandii	5.997	5.984	5.554	5.722	0.19
E. coli O157:H7	5.761 [a]	5.700 [a]	5.556 [a]	5.147 [b]	0.10
Faecal bacteria (log_{10}/mL)					
Clostridium aminophilum	8.469	8.568	8.650	8.526	0.13
Clostridium sticklandii	5.607	5.678	5.456	5.619	0.14
E. coli O157:H7	5.287 [a]	5.207 [a]	4.827 [b]	4.859 [b]	0.11

* Quantification of ruminal bacteria by real-time PCR ($log10^8$/mL or g).
**Values followed by different letters in the same column differ statistically from each other (P<0.05).
Study conducted by Prof. Dr Alejandro Plascencia Jorquera at Instituto de Investigaciones en Ciencias Veterinarias, Universidade Autónoma de Baja California, Mexico, 2018.

Table 3. Effect of live yeast and RumenYeast supplementation on the ruminal and faecal count of Clostridium aminophilum, Clostridium sticklanii and E. coli O 157:H7.

Conclusion

Food safety must be addressed throughout the production chain, as it is directly related to ensuring the quality of the final product and public health.

The improvement in animal health may result in higher productivity, lower antibiotic costs for treating sick animals, lower bacterial resistance from incomplete treatments, and less disease transmission among animals.

Thus, producers supplementing with RumenYeast will not only provide a perfect combination for the rumen, but also promote better sanitary control and reduction of contamination rates, which means better food safety and a lower risk of disease being transmitted to consumers. ■

References are available from the authors on request