IMPACT OF BIOLOGICAL ADDITIVES SUPPLEMENTATION ON MILK COMPOSITION AND RUMINAL PARAMETERS OF DAIRY COWS

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1. INTRODUCTION

Following a worldwide trend of reducing the use of antibiotics in animal production, the use of biological additives appears as an alternative in the nutrition of ruminants. The benefits of using these additives are seen through their effects in reducing greenhouse gas emissions by farm animals, as well as the better use of nutrients offered for conversion into food and the promotion of animal health. Probiotics and prebiotics both have great potential to improve livestock productivity as well as human health (UYENO et al., 2015).

Probiotics are, by definition, live microorganisms intentionally added to the animal diet to promote animal welfare and improve the use of nutrients. Prebiotics, on the other hand, are non-living and non-digestible components inserted in diets that beneficially affect animals, stimulating the growth or activity of beneficial populations that already exist in their gastrointestinal tract (SANTOS, 2011).

According to MAGNABOSCO et al. (2010), there are many forms of probiotics action, including changes in the ruminal microbiota, changes in rumen fermentation patterns, changes in the rate of passage in the intestine, increasing digestibility of nutrients and regulating the immune system.

Meta-analysis has been proposed as a method for obtaining useful summary estimates of effect, especially when numerous small studies have been conducted in different locations by different researchers using different study designs that, when considered individually, may not provide conclusive evidence of effect (POPPY et al., 2012 apud DERSIMONIAN and LAIRD, 1986; LEAN et al., 2009).

To clarify the points discussed, using a database of studies carried out with biological additives in the nutrition of ruminants, the objective of this work was to evaluate through meta-analysis the benefits of using probiotic and prebiotic additives in nutrition dairy cattle to maximize productivity and production efficiency.

2. MATERIALS AND METHODS

A database was compiled in an Excel spreadsheet, based on the search for articles available on search platforms, such as Elsevier, Scientific Electronic Library Online - Scielo, Science Direct, Scopus, PubMed, Wiley, Cambridge Core, Agrícola and Scholar Google. The keywords used were: “live yeast”, “yeast culture”, “prebiotics”, “probiotics”, “direct feed microbials”, “dairy cows”, “dairy cattle”, in different combinations.

Only works were included that: were published in journals with peer review; use dairy cattle (females only) in lactation; which have used probiotic and prebiotic as an experimental treatment; present variable responses about food consumption, rumen fermentation, milk production and composition and information about the composition of the animals' diet. Also, so the averages were weighted, studies needed to contain more than one observation per treatment, information on dispersion measures, such as standard error of the mean, standard deviation, coefficient of variation or number of observations that generated the mean. Studies that used in vitro evaluation were not included.

The selected treatments were: *Aspergillus oryzae*, Control, Prebiotics and Yeast. In total, 121 studies were collected in the database, containing 355 observations. After the construction of the database, these were evaluated by meta-analysis, grouped by additive and roughage: concentrate used as a basis in the animals' diet. Subsequently, the effect of the additive on food consumption, rumen fermentation, milk production and composition were evaluated.

The meta-analytical study of the data was performed using mixed models using the MIXED procedure of the SAS, in which the random study effect was included in the model using the RANDOM statement and the weighting for the weight of the means was included by the WEIGHT statement.

3. RESULTS AND DISCUSSION

The results found through the statistical analysis of the data demonstrated that the use of Yeast positively influenced all the milk components evaluated (Table 1). These results corroborate the studies by YALCIN et al. (2011), who demonstrated that yeast supplementation tended to increase the fat, protein, and lactose yields of the animals studied; SZUCS et al. (2013), who found an increase in the lactose content of the analyzed samples; DEHGHAN-BANADAKY et al. (2013), who stated that yeast supplementation showed beneficial effects on the percentage of milk fat. The explanation can be attributed to the fact that supplementation with yeast increases the digestibility of organic matter, increasing the energy available for the milk components production.

Table 1: Averages of milk components.

Variable*	Treatment								P-value
	AO		Control		Pre		Yeast		
FAT**% ± SEM	3.64^{b}	0.06	3.65^{b}	0.05	3.67^{ab}	0.05	3.70^{a}	0.05	0.0497
TS % ± SEM	12.1^{b}	0.33	12.25^{b}	0.20	12.4^{a}	0.24	12.7^{a}	0.21	<.0001
SNF***% ± SEM	8.80^{b}	0.08	8.80^{b}	0.08	8.77^{b}	0.08	8.99^{a}	0.08	0.0025
LAC ± SEM	4.77^{ab}	0.03	4.74^{b}	0.02	4.75^{b}	0.02	4.78^{a}	0.03	0.0024

$^{a-b}$ Means in the same row with the different superscripts differed significantly (Fisher's test *P* <0.05).
*FAT = milk fat; TS = total solids; SNF = solids non-fat; LAC = lactose; SEM= standard error of the mean; AO= *Aspergillus oryzae;* PRE=prebiotics.
**Days in milk and diet neutral detergent fiber were considered as covariate in the model.
***Days in milk were considered as covariate in the model

The Table 2 presents the results found for ruminal parameters referring to the different treatments used in diets for dairy cows. As can be seen, none of the parameters was influenced by the inclusion of biological additives. The main answer to the results found did not differ from each other is the fact that the diets contain proportions of concentrate: forage that does not present any challenge to the animals, values that can be seen in Table 3. The diet with the lowest concentration of forage had 42, 65%. Diets that include forage such as those in this study tend to help control the ruminal pH of the animals, which also controls the production of volatile fatty acids, keeping these at constant concentrations. GOULARTE et al. (2011) found that diets for dairy cows with up to 60% concentrate inclusion did not influence rumen volatile fatty acid concentrations.

Table 2: Averages of ruminal parameters.

Variable*	Treatment								P-value
	AO		Control		Pre		Yeast		
VFA ±SEM	110	4.79	107	4.29	109	4.69	108	4.32	0.467
Acet** ±SEM	62.5	0.70	62.7	0.65	62.5	0.69	62.7	0.70	0.891
Prop*** ±SEM	22.7	0.70	22.6	0.69	22.9	0.74	22.7	0.72	0.465
But*** ±SEM	11.1	0.36	11.1	0.34	10.9	0.35	11.1	0.37	0.698
Acet:Prop ±SEM	2.87	0.08	2.86	0.08	2.81	0.09	2.80	0.08	0.121

*VFA = volatile fatty acids; Acet = acetate; Prop = propionate; But = butyrate; Acet:Prop = ratio acetate propionate; SEM= standard error of the mean; AO= *Aspergillus oryzae;* PRE=prebiotics.
**Diet neutral detergent fiber and pH were considered as covariate in the model.
***Diet non-fiber carbohydrate was considered as covariate in the model.

Table 3: Forage: concentrate ratio of each treatment.

Variable	Ratio	SEM*
	Aspergillus oryzae	
Forage	42,65	1,51
Concentrate	57,35	1,51
	Control	
Forage	48,90	0,98
Concentrate	51,10	0,98
	Prebiotics	
Forage	48,22	1,62
Concentrate	51,78	1,62
	Yeast	
Forage	51,18	1,31
Concentrate	48,82	1,31

* SEM= standard error of the mean;

4. CONCLUSIONS

It was concluded with this work that the supplementation of diets for dairy cows with Yeast increases the concentration of milk solids. Also, it was found that supplementation with these additives does not influence ruminal fermentation parameters in diets that have forage proportions: concentrate with more than 40% forage.

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