PERFORMANCE AND CARCASS TRAITS OF BEEF CATTLE RECEIVING FIBROLYTICS ENZYMES

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1. INTRODUCTION

The research focus about enzymes for ruminants has been manly about the efficiency of fibrolytics enzymes (EUN & BEAUCHEMIN, 2005). Exogenous fibrolytics enzymes improve forage utilization, making available soluble carbohydrates from the cell wall by hydrolysis, as well the productive efficiency of ruminants (BEAUCHEMIN et al, 2003).

The use of exogenous fibrolytics enzymes to feed beef cattle has been studied almost sixty years ago, when BURROUGHS et al. (1960) demonstrated improvement of daily gain and feed efficiency in treated animals. Recent studies using exogenous fibrolytics enzymes in the beef cattle feeding also shown an improve feed utilization and animal performance (ARRIOLA et al., 2011; HOLTSHAUSEN et al., 2011). In contrast, other studies showed that not all results are positive when fibrolytics enzymes were added in the ruminants diets (BEAUCHEMIN et al, 2004).

The answer to a question about a specific treatment cannot come from an only study, once multiple studies about the same treatment may show different responses. In this context, the meta-analysis is an alternative to summarize or to establish the results more reliable across all the published studies (SAUVANT et al, 2008).

It is know that the use of exogenus enzymes in the monogastrics nutrition improve the feed utilization. However, for ruminants the use of enzymes in the diets are started to be used, and more research about it is still need. Thus, the objective was to evaluate across of meta-analysis the effect of fibrolytic enzymes types on performance and carcass traits in beef cattle.

2. METHODOLOGY

Eighteen peer-reviewed publications using beef cattle supplemented with fibrolytic enzymes was used for extraction and compiled data. Were evaluated dry matter intake, average daily gain (ADG), feed efficiency (FE), dressing, carcass weight (CW), ribeye area (RA), and fat thickness (FT). The variables were evaluated comparing animals non supplemented (control) and animal supplemented with different enzymes mixes (cellulase and xylanase, endoglucanase and xylanase).

The meta-analysis was performed as mixed models regressing the variables against the fixed effect of enzyme type using the MIXED procedure of SAS (v. 9.4 SAS Institute Inc., Cary, NC). The study effect was considered as a random effect and included in the model using the RANDOM statement (ST-PIERRE, 2001). The standard error of means or number of replicates (animals) by

treatment was used as the weighing factor in the model, using the weight statement of MIXED procedure of SAS. Covariates (average body weight (BW) and crude protein content of diets) were kept in the model when significant ($P < 0.05$). Distribution of random effects was assumed to be normal and the restricted maximum likelihood (REML) was used as the method of estimation (SAS INSTITUTE INC., 2008). Differences between means were determined using the P-DIFF option of the LSMEANS statement, which is based on Fisher´s F-protected at least significant difference test. Significant differences were declared at $P \leq 0.05$

3. RESULTS AND DISCUSSION

The results show that the mix enzyme of cellulase and xylanase improved the ADG (P<0,01) and FE (P<0,01) compared to treatment with endoglucanase and xylanase and the group without supplementation (Table 2). The increase of the ADG and FE can be explained according to the mean values of feed chemical composition of the studies used in this meta-analysis according to enzyme type (Table 1).

The diet type, mode of action and the enzyme feed specificity can explain the increase ADG and FE on studies with celulase and xylanase. Cellulase acts degrading the celulose on cell wall of plants and xylanase by degrading xylan, turning it into soluble sugars, improving the feed digestibility. Cellulose and xylan are mainly present on forage (VAN SOEST, 1994). The mean of forage level in the dry matter on total diet on studies used cellulase and xylanase was of 46%, 14.8% and 6.7% greater than the control and mix xylanase and endoglucanase, respectively. In agreement with our findings, MC ALLISTER et al. (1999) observed increased ADG of steers by 10% when applied enzymes in the diet based on 70% barley silage. Similarly BEAUCHEMIN et al. (1995) also observed increased the ADG by 30 and 36% on steers fed whit 96.7% by alfalfa hay on total diet and 91% by timothy hay on total diet respectively, compared to 91% by corn silage.

Dressing also improved to use by cellulase and xylanase (P 0.019). In this case, the increase is related to the increase of DMI that is more digestible, improving ADG and FE.

Table 1. Means of feed chemical composition of the studies used in this meta-analysis according to enzyme type.

	Control			Cellulase and xylanase			Endoglucanase and xylanase		
Variable	n	mean	sem	n	mea n	sem	n	mean	sem
DM, %	17	71.9	5.13	24	76.0	4.82	7	80.2	0.970
Forage level, % DM	35	31.2	5.26	36	46.0	6.88	19	39.3	7.48
CP, % DM	30	14.0	0.495	35	14.3	0.420	15	15.0	1.12
NDF, % DM	24	29.8	1.67	15	28.8	2.49	13	24.7	1.32
ADF, % DM	25	16.6	1.79	34	21.8	1.90	11	12.0	0.887
Lignin, % DM	5	3.66	1.14	18	4.57	0.493	3	1.60	0

Table 2. Effect of enzyme type on performance and carcass traits in beef cattle

	Variable	ADG*, kg	FE*, kg/kg	DMI†, kg/d	Dressing, %	CW†, kg	RA†, cm²	FT†, mm
Control	mean	1.36[b]	0.145[b]	9.57	58.3[b]	307[a]	75.4	9.72
	SEM	0.099	0.01	0.378	1.25	10.3	2.95	1.27
Cellulase and xylanase	mean	1.42[a]	0.157[a]	9.5	58.8[a]	305[b]	76.9	9.45
	SEM	0.099	0.01	0.402	1.25	10.3	2.98	1.27
Endoglucanase and xylanase	mean	1.39[ab]	0.147[b]	9.64	57.5[b]	304[b]	75.8	9.32
	SEM	0.103	0.01	0.387	1.27	10.3	2.99	1.27
σ²	study	0.146	0.0015	2.3	12.1	731	58.1	10.7
	residual	0.0045	5E-05	0.171	0.203	1.81	2.02	0.228
P-value		< 0.01	< 0.01	0.91	0.019	< 0.01	0.073	0.227

*Average BW and feed CP was covariate; † Average BW was covariate; [a-c] means followed by different letters at the same column show the effect of enzyme type (Fisher's test; P <0.05).
ADG= Average daily gain; FE= Feed efficiency; DMI=Dry matter intake; CW= Carcass weight; RA= Ribeye area; FT= Fat thickness.

According to HELDT-HANSEN (1997), the mainly action by mix enzyme of endoglucanase and xylanase is to hydrolysis the arabinoxylan and starch, explaining the fact that association of cellulase and xylanase presents the best responses regarding ADG, FE and dressing.

4. CONCLUSIONS

To improve the performance and dressing on beef cattle, we recommend the use of mix enzyme by cellulase and xylanase.

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