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Performance, carcass characteristics and gain cost of feedlot cattle fed a high level of concentrate and different feed additives

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ABSTRACT - The objective of this study was to evaluate the effects of feeding cattle with isoprotein and isoenergetic diets, with and without the addition of polyclonal antibody preparation (PAP), yeasts (YST) or monensin sodium (MON) on performance, carcass characteristics and gain cost in feedlot. Ninety-five 20-month old bullocks (323.3±21.8 kg) were distributed in 25 pens. The completely randomized experimental design had a 2 × 2 + 1 factorial arrangement and the treatments were replicated 5 times. There was no effect of MON for DMI throughout the feedlot period; however, MON reduced the dry matter intake (DMI) in g/kg of BW in the first 28 days when compared with the other treatments. The gain cost decreased with MON addition in relation to the other treatments. Inclusion of YST decreased average daily gain (ADG), final body weight, hot carcass weight, carcass weight, gain to feed ratio and DMI in g/kg body weight, worsening feed conversion and increasing the gain cost in the feeding periods. Inclusion of PAP increased ADG and decreased the gain cost, besides improving feed conversion. For MON and PAP, a difference was found for kidney-pelvic fat and kidney-pelvic fat per 100 kg of hot carcass weight. For MON and YST, there was a difference in ADG, feed conversion, gain cost and carcass yield and kidney-pelvic fat per 100 kg of hot carcass. Treatment YST worsened performance in relation to the non-supplemented treatments. Feeding PAP to animals did not influence performance and carcass characteristics of bullocks in feedlot negatively. Thus, PAP shows potential to substitute MON in cattle feeding using isoprotein and isoenergetic diets.

Key Words: cost, feedlot, monensin, polyclonal antibody preparation, yeasts

Introduction

The utilization of additives in animal feeding is a way to increase production. Management and modification of ruminal fermentation to improve animal performance have been the aim of a several studies on ruminant species (Martin & Nisbet, 1992; Hardy, 2002; Berghman & Waghela, 2004).

Among the additives that improve digestion or the amount of available nutrients for adsorption by the gastrointestinal tract and ruminant performance, monensin sodium ionophores and *Saccharomyces cerevisiae* probiotics are the mostly used in ruminant diets and, consequently, promote better animal performance (Martin & Nisbet, 1992; Millen et al., 2009).

Another way of managing ruminal fermentation and improving animal performance is immunization against lactic acid bacteria, which is very efficient to reduce the acidosis risks in cattle and sheep fed high-grain diets (Shu et al., 1999; Gill et al., 2000), Ikemori et al. (1992) and Lee et al. (2002) showed the potential of the immunization technique to favor the protection against specific pathogens. In a study by Ikemori et al. (1997), the reduction of diarrhea incidence was observed in newborn calves fed bovine colostrum powder or egg yolk from hens vaccinated against bovine coronavirus. Moreover, the immunization utilizing polyclonal antibody preparation (PAP) against *Streptococcus bovis* (PAP-SB) or *Fusobacterium necrophorum* (PAP-Fn) decreased the ruminal counting of target bacteria and increased ruminal pH of bullocks fed high-grain diets (DiLorenzo et al., 2006).

Therefore, the objective of this study was to evaluate the effects of supplementation with polyclonal antibody preparation, yeast (Yea-Sacc, 5 x 10^9 ufc of *Saccharomyces cerevisiae* strain 1026®) and the interaction between the polyclonal antibody preparations and yeast and monoensin

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sodium on performance, carcass characteristics and cost per kilo gained in feedlot Nellore cattle fed high-concentrate diets.

Material and Methods

The experiment was developed in the beef cattle feedlot sector of the Faculdade de Medicina Veterinária e Zootecnia (FMVZ), Campus of Botucatu, São Paulo state (Brazil), Universidade Estadual de São Paulo (UNESP), Departamento de Genética e Nutrição Animal. This study followed the ethical principles of the ethics committee for animal experimentation (CEUA) of the university, under the protocol no. 173/2009-CEUA.

For the experimental development, 95 Nellore bullocks from continuous grazing breeding system, average age of 20 months and average live weight of 323.03±22.08 kg were distributed into 5 treatments: only ration - control (CTL); ration + polyclonal antibody preparation (PAP) additive; ration + live yeast – Yea-Sacc, 5 x 10^9 ufc of *Saccharomyces cerevisiae* strain 1026 (YST); PAP + YST (MIX); and ration + monensin sodium (MON) additive.

All 95 animals were housed in a covered feedlot, subdivided in collective pens with an available area of 7.5 m² per animal and 1.25 m linear feed bunk per animal. The pens had slatted floors, suspended at ±1.5 m of height, and automatic drinkers, making it easier to be cleaned.

All animals were subjected to the same management and distributed into the pens as follows: CTL - distributed into 4 pens with 4 animals and 1 pen with 3 animals; PAP - distributed into 5 pens with 4 animals; YST - distributed into 3 pens with 4 animals and 2 pens with 3 animals; MIX - distributed into 4 pens with 4 animals and 1 pen with 3 animals.

The rations supplied were isoprotein and isoenergetic, formulated according to the nutritional requirements described by the NRC (2000) and evaluated by level 2CNCPS model (2000) (Table 1), expecting daily weight gains between 1.4 and 1.5 kg/animal. The animals were fed *ad libitum* twice a day (40% at 08h00 and 60% at 15h00) with constant water provision through automatic drinkers.

The ration provided to the cattle of this experiment only differed as to the inclusion or non-inclusion of the feed additives utilized. The doses of each additive used were: PAP - 450 mg/kg of dry matter; YST - 450 mg/kg of dry matter; MIX - 450 mg/kg of dry matter of PAP and 450 mg/kg of dry matter of YST; and MON - 30 mg/kg of dry matter.

Table 1 - Utilization periods, concentrate level, composition and nutritional content of total diets provided to cattle during the feedlot period

Utilization periods	Diet[1]					
	Adaptation 01	Adaptation 02	Adaptation 03	Growth 01	Growth 02	Finishing
08/21 to 09/17/2009 (0 to 28 days)	7 days	7 days	7 days	7 days		
09/18 to 10/15/2009 (29 to 56 days)				7 days	21 days	
10/16 to 11/12/2009 (57 to 84 days)					14 days	14 days
11/13 to 12/10/2009 (85 to 112 days)						28 days
Concentrate level (%)	56.00	63.00	70.00	71.00	76.00	79.00
Ingredients			g/kg of DM			
Fresh sugarcane bagasse	221.60	228.60	221.70	232.20	190.90	118.00
Coast-cross grass hay	216.20	137.10	80.00	60.00	51.40	97.80
Moist corn grain silage	257.30	323.40	409.10	435.60	484.60	534.90
Pellet citrus pulp	99.50	126.90	114.30	105.60	114.30	116.70
Soybean meal	43.20	-	-	-	-	-
Peanut meal	144.90	165.70	156.60	148.90	140.60	116.70
Mineral supplement with urea*	17.30	18.30	18.30	17.80	18.30	16.00
Nutritional content						
Dry matter (g/kg)	740.00	730.00	720.00	720.00	720.00	710.00
Total digestible nutrients[2] (g/kg of DM)	710.00	740.00	760.00	760.00	780.00	810.00
Crude protein (g/kg of DM)	160.00	154.00	152.00	150.00	150.00	142.00
Ether extract (g/kg of DM)	25.70	27.00	30.60	34.10	34.50	36.00
Neutral detergent fiber (g/kg of DM)	353.00	307.00	258.00	250.00	213.00	188.00
Physically effective NDF (g/kg of DM)	320.00	270.00	220.00	220.00	180.00	160.00
Ca (g/kg of DM)	4.10	4.40	6.70	6.40	6.50	6.20
P (g/kg of DM)	2.90	2.80	3.30	3.30	3.40	3.30

DM - dry matter; NDF - neutral detergent fiber; TDN - total digestible nutrients.
[1] Utilization periods, ingredients and nutritional composition of diets throughout the experimental period.
[2] Formula utilized to estimate TDN = 86.0834 – 0.3862 NDF.
* Guaranteed levels per kg of mineral supplement with urea: phosphorus - 25 g; calcium - 155 g; magnesium - 11 g; sulfur - 30 g; sodium - 35 g; zinc - 1.180 mg; copper - 430 mg; manganese - 250 mg; iron - 620 mg; cobalt - 28 mg; iodine - 100 mg; selenium - 10 mg; fluoride - 250 mg; urea - 30%; Non-protein nitrogen (equivalent protein) - 90%

The additives were provided in powder, mixed to the mineral supplement with urea, using a stainless steel Y mixer with carbon steel structure and epoxy painting. To calculate the amount of feed additive to be added in each 30 kg bag of mineral supplement with urea, the daily dry matter intake was fixed at 10 kg.

After estimating the daily feed intake per pen and per treatment and calculating the total preparation of feed per delivery, the amount of mineral supplement with urea and its respective additives was weighed in plastic pots and manually incorporated to the total feed supplied to each pen of each treatment.

Before the beginning of the experiment, all cattle were weighed, vaccinated, dewormed and subjected to a 20-day pre-adaptation period to reduce stress due to the new environment and facilities and to standardize their ruminal population.

The pre-adaptation diet consisted of fresh sugarcane bagasse, coast-cross grass hay, soybean meal, peanut meal, and mineral supplement with urea at concentrations of 255.40, 500.00, 108.40, 122.90 and 13.30 g/kg of dry matter.

After the pre-adaptation, animals were weighed again and the experiment was started by using the rations called adaptation 1, 2 and 3, and growth for 7-day periods, totalizing the period from 0 to 28 days of the study (Table 1). Next, the animals received growth ration for 7 more days, and then they were provided with growth ration 02 for 21 days, corresponding to the period from 29 to 56 days (Table 1).

Growth ration 02 was formulated with 79% of concentrate, provided for 14 days, from day 57 to 84, following the step-up adaptation protocol, and in the last 28 days of the feedlot period, from 85 to 112 days (Table 1).

Dry matter intake was measured for each pen by daily weighing the feed supplied and the refusals before the morning delivery, and then calculating the daily intake per animal. Ration dry matter was also calculated every day to obtain the daily dry matter intake in kilograms. The data of dry matter intake were also expressed in g/kg of body weight.

To measure the initial and final live weight, the cattle were weighed for two consecutive days, and the initial and final weights were obtained through the average of the weighing days. Still before the first and last weight assessments, the feed was restricted to 2% of the average live weight of animals, for three days to eliminate the weight difference of gastrointestinal content. To obtain intermediate weights of the first and last weight assessments, the cattle were weighed every 28 days, without fasting, and 4% of the assessed weight was not considered to obtain the live weight. Thus, at the end of the experiment, the daily weight gain of the animals was calculated, utilizing the data obtained in the initial and final weight assessments, following the method described by Lush & Black (1927) and Patterson (1947).

Afterwards, feed conversion was calculated by dividing the total dry matter intake by the total live weight gained during the experiment. The intermediate weight assessments were used to monitor the daily live weight gain and to adjust the amounts of the ingredients in the diet whenever necessary.

Throughout the experimental period, weekly samplings of the diet were done for laboratory analysis of dry matter (DM), crude protein (CP), ethereal extract (EE) and mineral material (MM), according to the AOAC (1995), and neutral detergent fiber (NDF) according to Goering & Van Soest (1970); their total digestible nutrients (TDN) were calculated using the equation: TDN = 86.0834 – 0.3862 NDF, proposed by Tibo (2000). The results were expressed in g/kg of DM.

The feed delivery of total diet per pen was adjusted daily by weighing the refusals in feeders of each pen and the visual evaluation of these refusals before the first delivery (8h00), ensuring that the refusal percentage was never lower than 10%.

After the 112-day feedlot period, the animals were feed-deprived for 24 hours in lairage pens and slaughtered in a commercial slaughterhouse, Vangélio Mondelli Ltda., located in Bauru-SP, 96 km away from the feedlot location in Botucatu-SP. Animals were stunned, exsanguinated, skinned and eviscerated, and the carcass was cut into two half-carcasses. The carcass chilling was done in cold rooms at temperatures between zero and two degrees Celsius for 24 hours, following the Regulations of Industrial and Sanitary Inspection of Animal Products (RIISPOA, 2006).

Hot carcass yield was obtained by dividing the sum of half-carcass weight provided by the meat industry and the animal live weight. The proportion of kidney-pelvic fat was established by dividing the weight of fat in the kidneys and pelvis by the hot carcass weight.

The *longissimus dorsi* muscle area (LMA), subcutaneous fat thickness (SFT), and rump fat thickness (RFT) were assessed through two measurements (ten days after the adaptation period and nine days before the slaughter). All animals from each treatment were used and the LMA and SFT measurements were done between the 12th and 13th ribs of the *longissimus dorsi* muscle area, and RFT was measured between the thigh tuberosity (ilium) and the ischial tuberosity (ischium) in the region of the

biceps femoris muscle. All images were taken by the same technician, according to the technique described by Perkins et al. (1992) and Gresham (1998), utilizing *Pie medical ScanVet-200* equipped with a 17.2 cm and 3.5 MHz linear probe. The images were produced in the equipment itself by the assessing technician.

The LMA daily gains, subcutaneous fat thickness (DSFT) and *biceps femoris* muscle subcutaneous fat thickness were calculated through the following formula:

Daily gain in LMA, SFT and RFT = (Final measure – Initial measure)/65 days

Where 65 days = number of days between the initial and final evaluation.

The economic analysis was based on the "cost per kilo gained", i.e., how much it cost for the animal to gain one kilogram of live weight when the treatments were compared. The gain cost was calculated according to this formula:

$$\text{Gain cost (R\$ / kg)} = \frac{\text{DM intake (kg) x Cost/kg of diet DM (R\$)}}{\text{Daily live weight gain (kg/day)}}$$

The experimental design was completely randomized and the pens were considered experimental units. Normality and variance heterogeneity tests were done before the variance analysis and, whenever necessary, the data were transformed. The results were considered significant at P<0.05.

The performance data were tabulated separately per periods (0 to 28 days, 0 to 56 days, 0 to 84 days, and 0 to 112 days) in a 2 × 2 + 1 factorial design, where the effects of inclusion or non-inclusion of polyclonal antibody (PAP) or live yeast (YST) plus the additional treatment that contained monensin sodium (MON) were analyzed using PROC MIXED of software SAS (Statistical Analysis System, version 9.1) according to the model:

Model 1

$$Y_{ij} = \mu + T_i + e_{ij};$$

where: Y_{ij} = observation related to the j-th experimental unity (pen) of the i-th treatment; μ = general average; T_i = effect of the i-th treatment, where i = 1: MON, 2: Control, 3: PAP, 4: YST, 5: PAP+YST; e_{ij} = experimental error referring to the j-th experimental unity of the i-th treatment $(0; \sigma^2_e)$.

When there was interaction between the treatments, the data were analyzed by PROC MIXED of SAS (Statistical Analysis System, version 9.1) and Tukey's test for average comparison. The results were considered significant at P<0.05.

Data referring to initial live weight, final live weight, hot carcass weight and carcass yield were analyzed by the same model; however, only the period from 0 to 112 days was considered in the analysis because the variables were collected at day 0 or at day 112.

The treatment effects were deployed in the following orthogonal contrasts utilizing the CONTRAST option of SAS (Statistical Analysis System, version 9.1): average effect of PAP [(PAP and PAP+YST) vs. (YST and Control)], average effect of YST [(YST and PAP+YST) vs. (PAP and Control)], interaction of PAP × YST and MON vs. other treatments. Dunnett's test was adopted for the following comparisons: MON vs. PAP, MON vs. YST, MON vs. PAP+YST and MON vs. control.

Results and Discussion

No effect of polyclonal antibody preparation or yeast inclusion was observed (P>0.05) on daily dry matter in kilos and live weight percentage in the periods from 0 to 28, 0 to 56 and 0 to 112 days (Table 2).

However, the addition of yeast reduced (P<0.05) dry matter intake in kilos and dry matter intake in percentage of live weight in the period from 0 to 84 days (Table 2). Likewise, in the period from 8 to 84 days, the cattle fed monensin sodium presented lower intake (P<0.05) of dry matter in kilos in relation to the animals that did not receive any additive in the diet. However, in the period from 0 to 112 days, cattle fed monensin sodium had lower dry matter intake (P<0.05) in percentage of live weight than the animals in the group that did not receive feed additive (Table 2).

The inclusion of yeasts in the diets for ruminants usually increases dry matter intake and neutral detergent fiber (NDF) (Williams et al., 1991; Carro et al., 1992; Kung et al., 1997). This occurs because live yeasts increase the number of bacteria in the rumen, especially cellulolytic bacteria (Dawson et al., 1990; Newbold et al., 1995), probably because this increase in dry matter intake and NDF reflects the constant energy intake with a lower amount of dry matter intake, explaining the reductions of dry matter intake in kilos and in percentage of live weight in the period from 0 to 84 days for cattle supplemented with yeast (Minson, 1990).

Still regarding dry matter intake (g/kg of live weight), there was an effect of monensin sodium inclusion (P<0.05), and cattle supplemented with monensin presented lower dry matter intake when compared with the other treatments in the period from 0 to 84 days. The animals that did not receive feed supplement presented higher dry matter intake (P<0.05) when compared with the animals supplemented in the periods from 0 to 84 days and 0 to 112 days (Table 2).

Table 2 - Daily dry matter intake and live weight percentage, feed conversion and gain cost of Nellore cattle finished in feedlot and fed diets with a high level of concentrate and different feed additive

Item	Factors						SEM	Absolute values of contrasts and their respective P values			
	YST		PAP					MON vs. CTL	MON vs. PAP	MON vs. YST	MON vs. MIX
	With	Without	With	Without	MON	Others[1]					
Dry matter intake							kg/day				
0 to 28 days	7.77	7.75	7.81	7.71	7.42	7.76	0.19	7.70/0.319	7.80/0.180	7.72/0.284	7.82/0.162
0 to 56 days	7.78	7.99	7.90	7.87	7.71	7.88	0.13	8.00/0.130	7.97/0.169	7.74/0.857	7.82/0.533
0 to 84 days	7.94b	8.23a	8.09	8.08	8.00	8.08	0.11	8.29*/0.050	8.16/0.295	7.86/0.362	8.01/0.930
0 to 112 days	8.08	8.33	8.18	8.23	8.14	8.20	0.11	8.42/0.101	8.23/0.548	8.03/0.603	8.13/0.938
Dry matter intake							g/kg body weight				
0 to 28 days	23.00	22.90	23.00	22.90	21.90b	22.90a	0.05	22.80/0.204	23.00/0.129	22.90/0.145	23.00/0.111
0 to 56 days	22.10	22.30	22.20	22.20	21.60	22.20	0.03	22.30/0.162	22.30/0.123	22.00/0.424	22.10/0.253
0 to 84 days	21.20b	21.70a	21.40	21.50	21.10	21.40	0.02	21.80/0.040	21.50/0.184	21.10/0.973	21.30/0.537
0 to 112 days	21.00	21.30	21.10	21.20	20.80	21.10	0.02	21.50*/0.028	21.00/0.305	20.80/0.927	21.20/0.175
Average daily weight gain							kg/day				
0 to 28 days	1.23	1.24	1.30a	1.17b	1.33	1.24	0.06	1.14*/0.045	1.34/0.935	1.20/0.159	1.25/0.333
0 to 56 days	1.03b	1.26a	1.15	1.14	1.19	1.14	0.04	1.29/0.135	1.22/0.518	0.99*/0.048	1.07/0.167
0 to 84 days	1.19b	1.33a	1.29	1.23	1.33	1.26	0.04	1.33/0.940	1.32/0.799	1.13*/0.003	1.25/0.157
0 to 112 days	1.13b	1.24a	1.20	1.17	1.24	1.18	0.04	1.24/0.895	1.23/0.749	1.10*/0.014	1.16/0.132
Feed conversion							kg DM/kg daily weight gain				
0 to 28 days	6.35	6.29	6.04b	6.56a	5.58b	6.26a	0.25	6.75*/0.001	5.82/0.117	6.44*/0.013	6.26*/0.029
0 to 56 days	7.57a	6.37b	6.92	7.01	6.49	6.91	0.41	6.20/0.869	6.53/0.527	7.82/0.186	7.31/0.448
0 to 84 days	6.69	6.21	6.30b	6.60a	6.02	6.42	0.29	6.23/0.997	6.18/0.602	6.96/0.107	6.41/0.813
0 to 112 days	7.16a	6.74b	6.85	7.04	6.56	6.95	0.24	6.79/0.698	6.69/0.098	7.30*/0.006	7.01*/0.009
Gain cost							Cost in R$ per kilogram of live weight gained in feedlot				
0 to 28 days	2.48	2.45	2.35b	2.58a	2.14b	2.46a	0.09	2.64*/0.003	2.26/0.393	2.52*/0.016	2.43*/0.049
0 to 56 days[C]	3.00	2.48	2.67	2.81	2.56	2.74	0.08	2.43/0.266	2.53/0.709	3.18*/0.016	2.81/0.064
0 to 84 days	2.64a	2.44b	2.48	2.60	2.39b	2.54a	0.06	2.45/0.487	2.43/0.620	2.74*/0.001	2.53/0.128
0 to 112 days	2.88a	2.82b	2.75	2.82	2.62b	2.79a	0.06	2.72/0.237	2.67/0.583	2.92*/0.002	2.83*/0.022

Means followed by different letters differ (P<0.05).
CTL - only ration (Control); PAP - ration + polyclonal antibody preparation additive; YST - ration + live yeast (Yea-Sacc, 5 x 10^9 ufc of *Saccharomyces cerevisiae* strain 1026); MIX - PAP + YST; MON - ration + monensin sodium additive.
[1] Others – average of treatments CTL, PAP, YST and MIX; SEM - standard error of the mean.
* Significant comparison (P<0.05) by Dunnett's test.
[C] Interaction between PAP and YST (P<0.05, Table 3).

Monensin sodium inclusion causes increase of molar concentration of propionic acid in the ruminal environment, with concomitant reduction of acetic acid, butyric acid, lactic acid, methane gas, carbon dioxide and ammonia (Machado & Madeira, 1990), the smallest dietetic amino acid fermentation in the rumen, compensated by its best use in the small intestine (Medel et al., 1991).

In high-grain diets, ionophores reduce the feed intake and improve feed conversion, keeping or increasing daily gain weight (Table 2) without affecting the carcass yield (Table 3). When the ionophore is included in the diet, the intake may be initially reduced by about 15%, and after some days, 90% of the original intake is regained (Dickie & Forsyth, 1982; Kunkle & Sand, 1998; Stock & Mader, 1998).

In the present study, monensin sodium supplementation improved (P<0.05) feed conversion (FC) of animals compared with the other treatments in the initial feedlot period from 0 to 28 days, and the effect of supplementation (P<0.05) is also observed with polyclonal antibody preparation when compared with yeast and the non-utilization of additives in high-energy diets (Table 2).

Cattle supplemented with yeast presented the worst feed conversion (P<0.05) in relation to the animals that were not; however, the cattle that were supplemented with monensin sodium presented better feed conversion (P<0.05) than cattle treated with yeast and the animals treated with yeast and polyclonal antibody preparation by Dunnett's test (Table 2), and, therefore, the yeast supplement in the ration reduced feed conversion in the total feedlot period (0 to 112 days), but the addition of polyclonal antibody preparation did not have an effect (P>0.05) on the feed conversion in the same period.

Byers (1980) reported that the animals receiving high-concentrate diets associated with monensin supplementation presented improvement in performance variables because this additive increases the utilization efficiency of net energy for gain (NEg) in relation to the net energy for maintenance (NEm) by the animal, which decreases the daily dry matter without affecting daily average weight gain, consequently improving the feed efficiency assessed in this experiment by the cost per kilogram of live weight in feedlot.

The yeast inclusion in the ration utilized in the present study resulted in smaller daily weight gain (P<0.05) in the periods from 0 to 56, 0 to 84 and 0 to 112 days. However, the addition of polyclonal antibody preparation increased (P<0.05) daily average weight gain of cattle during the period from 0 to 28 days, but it did not affect (P>0.05) the gain in the other periods evaluated.

Regarding the additional treatment, animals supplemented with monensin sodium presented greater average daily weight gains (P<0.05) when compared with animals supplemented with yeast in the periods from 0 to 56, 0 to 84 and 0 to 112 days. However, no differences regarding average daily weight gain were detected in the animals that received monensin sodium and polyclonal antibody preparation. Several authors report that they had not found an explanation for the increase of weight gain of cattle when provided with diets supplemented with yeast (Malcolm & Kiesling, 1990; Mir & Mir, 1994; Fiems et al., 1995; Kung et al., 1997; Doreau & Jouany, 1998) (Table 3).

Fereli et al. (2010) reported that the use of *Saccharomyces cerevisiae* in high-concentrate diets for cattle increases the production of microbial mass and promotes a greater flow of bacterial protein available to the animal when compared with the use of monensin sodium which increases the ruminal digestibility and total digestibility of crude protein in comparison with the use of *Saccharomyces cerevisiae*; this digestibility increase may contribute to the weight gain of animals that were fed monensin sodium.

Considering the gain cost of one kilogram of live weight in feedlot, the addition of yeast to the ration increased (P<0.05) the cost throughout all studied periods from 0 to 28, 0 to 56, 0 to 84 and 0 to 112 days. On the other hand, the inclusion of polyclonal antibody preparation reduced (P<0.05) the gain cost only in the period from to 28 days, and there was no effect (P>0.05) of its addition on the other assessed periods. However, the supplementation with monensin sodium reduced (P<0.05) the cost of one kilogram of live weight when compared with the average of the other treatments in the periods from 0 to 28, 0 to 84 and 0 to 112 days. Nevertheless, cattle supplemented with monensin sodium presented gain cost similar to (P<0.05) those supplemented only with polyclonal antibody preparation.

In the period from 0 to 56 days, there was interaction (P<0.05) between the inclusion of additives, polyclonal antibody preparation and yeast. When interaction was deployed, it was observed that the supplementation with yeast increased the yield cost in diets that did not contain polyclonal antibody preparation, which did not occur when the latter was added (Table 4). This can be explained by the fact that cattle supplemented with polyclonal antibody preparation presented the same daily dry matter intake as the cattle supplemented with yeast, but with greater average daily weight gain, and because additives have different values in commercialization.

The main effect of yeast addition was not observed (P>0.05) for initial live weight, carcass yield, kidney-pelvic fat, kidney-pelvic fat on the percentage of hot carcass weight, initial and final LMA, initial and final SFT, initial and final RFT, and daily gain in SFT and RFT (Table 4).

Table 3 - Initial and final live weight, carcass characteristics and fat and muscular growth of Nellore cattle fed diets with a high level of concentrates and different feed additives

Item	Factors						SEM	Absolute values of contrasts and their respective P values			
	YST		PAP					MON vs. CTL	MON vs. PAP	MON vs. YST	MON vs. MIX
	With	Without	With	Without	MON	Others[1]					
Live weight							kg				
Initial	323.58	322.55	323.04	323.08	322.69	323.24	0.90	322.94/0.848	322.85/0.903	323.92/0.352	323.23/0.680
Final	450.07b	460.70a	456.59	454.18	461.85	455.39	4.56	461.27/0.929	460.13/0.793	447.09*/0.039	453.05/0.195
Hot carcass weight	252.77b	258.46a	256.16	255.07	262.26a	255.61b	3.06	256.15/0.182	260.76/0.736	253.99*/0.048	251.55*/0.027
Carcass yield							g/kg body weight				
Kg/100 kg of body weight	56.61	56.18	56.39	56.40	56.83	56.39	0.59	55.55/0.060	56.80/0.975	57.24/0.423	55.97/0.602
Carcass weight (in arrobas)	16.87b	17.24a	17.01	16.56	17.49a	17.05b	0.20	17.07/0.166	17.40/0.770	16.94*/0.048	16.79*/0.030
Kidney-pelvic fat (kg)	4.07	4.23	4.06	4.24	4.74a	4.15b	0.20	4.39/0.253	4.07*/0.040	4.09*/0.046	4.05*/0.036
kg/100 kg of hot carcass	1.61	1.63	1.59	1.65	1.78a	1.62b	0.07	1.69/0.367	1.57*/0.050	1.61/0.109	1.61/0.106
Longissimus muscle area							cm²				
Initial	53.91	55.12	54.77	54.27	53.16	54.52	0.90	54.81/0.187	55.43/0.074	53.72/0.365	54.10/0.379
Final	59.76	62.73	61.12	61.34	61.10	61.24	1.37	63.04/0.217	62.41/0.119	59.69/0.690	59.82/0.369
Daily gain	0.09b	0.12a	0.10	0.11	0.12	0.11	0.01	0.13/0.187	0.11/0.075	0.09/0.365	0.09/0.319
Subcutaneous fat thickness							mm				
Initial	1.98	1.92	2.07	1.83	2.05	1.95	0.14	1.83/0.351	2.00/0.888	1.82/0.319	2.14/0.716
Final	3.90	3.99	3.94	3.95	4.38	3.94	0.20	3.89/0.308	4.08/0.638	4.00/0.364	3.80/0.254
Daily gain	0.03	0.03	0.03	0.03	0.04	0.03	0.00	0.03/0.244	0.03/0.265	0.03/0.526	0.03/0.064
Rump fat thickness							mm				
Initial	2.73	2.74	2.81	2.66	2.96	2.73	0.12	2.82/0.527	2.66/0.313	2.50*/0.027	2.95/0.924
Final	5.47	5.49	5.40	5.56	5.75	5.48	0.27	5.67/0.830	5.30/0.266	5.44/0.428	5.49/0.506
Daily gain	0.05	0.04	0.04	0.05	0.04	0.04	0.00	0.04/0.645	0.04/0.811	0.05/0.455	0.04/0.480

CTL - animals fed only ration (Control); PAP - ration + polyclonal antibody preparation additive; YST - ration + live yeast (Yea-Sacc, 5 x 10^9 ufc of *Saccharomyces cerevisiae* strain 1026); MIX - PAP + YST; MON - ration + monensin sodium additive; SEM - standard error of the mean.
[1] Others – average of treatments CTL, PAP, YST and MIX (PAP+YST).
Means followed by different letters differ (P<0.05).
*Significant comparison (P<0.05) by Dunnett's test.

However, the addition of yeast to rations resulted in lower (P<0.05) final live weight, hot carcass weight, carcass weight, and daily gain in LMA when compared with animals that were not supplemented with yeast (Table 3). On the other hand, the addition of polyclonal antibody preparation to the rations did not affect (P>0.05) any response variables measured related to carcass traits.

Cattle fed monensin sodium presented greater (P<0.05) hot carcass weight and kidney-pelvic fat compared with the average of the other treatments. When the monensin sodium supplementation was compared with each treatment individually, greater (P<0.05) hot carcass weight and kidney-pelvic fat were observed in relation to the cattle supplemented with yeast, polyclonal antibody preparation and yeast plus polyclonal antibody preparation. Nevertheless, for the kidney-pelvic fat in percentage of hot carcass weight, animals supplemented with monensin sodium had greater kidney-pelvic fat (P<0.05) only in relation to the cattle supplemented with polyclonal antibody preparation (Table 3).

When the values of kidney-pelvic fat were expressed in relation to 100 kg of hot carcass, the carcasses of animals that were fed ration with polyclonal antibody preparation presented (P<0.05) a smaller amount of kidney-pelvic fat in relation to the carcasses of animals that received the ration with addition of monensin sodium (Table 3). This can be associated with a more efficient action of the polyclonal antibody preparation to increase ruminal digestibility and total protein in comparison with the use of *Saccharomyces cerevisiae* on the ruminal environment managements (DiLorenzo et al., 2006; Fereli et al., 2010; Gomes et al., 2010).

For the initial and final LMA area, initial and final SFT, initial and final RFT, daily gain in LMA area, daily gain in SFT and daily gain in RFT, with the effect of MON (P>0.05) was not observed when compared to the other treatments (Table 3).

Table 4 - Interaction effect of inclusion factors of polyclonal antibody preparation and live yeasts on gain cost (R$) in the feedlot period from 0 to 56 days of Nellore cattle fed high-concetrate diets and finished in feedlot

		YST		Mean
		With	Without	
PAP	With	2.81ba	2.53ba	2.67
	Without	3.18aa	2.43ba	2.81
	Average	3.00	2.48	

Means followed by the same letter in the rows and columns do not differ (P<0.05) by Tukey's test.
PAP - ration + polyclonal antibody preparation additive; YST - ration + live yeast (Yea-Sacc, 5 x 10^9 ufc of *Saccharomyces cerevisiae* strain 1026).

Supplementing dairy cows with live yeast, Magalhães et al. (2008) did not find alterations in dry matter intake, live weight gain and efficiency of diet energy utilization. Gomes et al. (2010), adding live yeasts and monensin sodium to the diet of Nellore cattle, found higher concentration of acetate, lower concentration of propionate and butyrate, higher concentration of ruminal ammonia, lower acetate: propionate ratio and lower rate of effective degradation of feed for animals supplemented with live yeast when evaluating ruminal parameters.

These associated factors made Magalhães et al. (2008) and Gomes et al. (2010) conclude that the supplementation with live yeasts worsened microbial fermentation of cattle, suggesting that the lower production of propionate along with the lower effective degradation rate of feed in the rumen may have affected the performance of cattle, decreasing their daily weight gain and making them present lower final live weight, hot carcass weight, carcass yield, kidney-pelvis fat and daily gain in the LMA area.

Conclusions

The utilization of live yeasts in high-concentrate diets results in an increase of 9.22% of cost per kilo gained in feedlot because it worsens feed conversion, reduces performance and characteristics related to carcass muscularity of cattle fed them. The utilization of polyclonal antibody preparations in high-concentrate diets does not result in an increase of the cost per kilo gained in feedlot, but increases the amount of visceral fat in the carcass of animals that received them. The utilization of monensin sodium in high-concentrate diets is efficient.

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