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Cientific Paper

Probiotic (*Saccharomyces cerevisiae*) effect on carcass characteristics and non-integrant components of Holsteinbull calves in feedlot

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Abstract

The aim of this study was to evaluate the effect of inclusion of probiotic *Saccharomyces cerevisiae* based on carcass characteristics of Holstein steers finished in feedlot. The experiment was conducted at the Midwest State University in the Center of Animal Production (NUPRAN). 24 Holstein steers were used with initial age of 192 days and initial body weight of 221 kg with a standard deviation of 7 kg. The experiment had a 210 days duration. The inclusion of probiotic containing the yeast *Saccharomyces cerevisiae* KA_{500} ($2x10^{10}$ CFU g^{-1}) was provided at the order of 10 g $animal^{-1}$ day^{-1}. At the end of the feedlot, following a fasting period of 12 hours, the animals were weighed before loading to the fridge. The slaughter followed the normal flow of a slaughterhouse. The probiotic containing live yeast resulted in no significant effect ($p > 0.05$) on the features and components that are not part of the carcass.

Keywords: additive; carcass yield; dairy steers; live yeast.

Efeito do probiótico (Saccharomyces cerevisiae) sobre as características e componentes não integrantes de carcaça de novilhos holandeses superjovens terminados em confinamento

Resumo

O experimento foi realizado no Núcleo de produção animal da Universidade Estadual do Centro Oeste (NUPRAN). O objetivo do trabalho foi avaliar o efeito da inclusão dietética do probiótico (*Saccharomyces cerevisiae*) sobre as características e os componentes não integrantes de carcaça de novilhos holandeses superjovens terminados em confinamento. Foram utilizados 24 novilhos da raça Holandesa com idade média inicial de 192 dias de vida e peso corporal médio inicial de 221 kg. O delineamento experimental foi o inteiramente casualizado, constituído de dois tratamentos (dietas com ou sem probiótico) e seis repetições, onde cada repetição foi representada por uma baia com dois animais. O confinamento teve duração de 210 dias. A inclusão do probiótico contendo a levedura *Saccharomyces cerevisiae* cepa KA500 (2x1010 UFC g^{-1}), foi fornecido a cada animal na ordem de 10 g dia^{-1}. Ao término do confinamento, obedecendo a um jejum de sólidos de 12 horas, os animais foram pesados antes do carregamento para o frigorífico. Os abates seguiram o fluxo normal de um abatedouro. O probiótico contendo leveduras vivas não gerou efeito significativo ($p>0,05$) sobre as características e componentes não integrantes de carcaça.

Palavras-chave: aditivo; leveduras vivas; novilhos leiteiros; rendimento de carcaça.

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Efecto probiótico de (Saccharomyces cerevisiae) sobre las características y componentes no integrantes de la canal en terneros da raza holandesa en confinamiento

Resumen

El objetivo de este estudio fue evaluar el efecto de la inclusión de probióticos basados en *Saccharomyces cerevisiae* en las características de la canal de novillos holandeses terminados en confinamiento. El experimento se llevó a cabo en la Universidad Estadual do Centro Oeste en el Centro de Producción Animal (NUPRAN). Fueron utilizados 24 novillos holandeses con la edad inicial de 192 días y peso corporal inicial de 221 kg con una desviación estándar de 7 kg. El experimento tuvo una duración 210 días. La inclusión de probióticos contiendo la levadura *Saccharomyces cerevisiae* KA_{500} ($2x10^{10}$ UFC g^{-1}) fue proporcionada en el orden de 10 g animales^{-1} día^{-1}. Al final del confinamiento después de un período de ayuno de 12 horas, los animales fueron pesaron antes de seguir para el matadero. La masacre siguió el flujo normal de un matadero. El probiótico que contiene levadura no ha causado ninguno efecto significativo ($p> 0,05$) en las características y componentes que no forman parte de la canal.

Palabras clave: aditivos; rendimiento de la canal; dairy steers; levaduras vivas.

Introduction

One of the many byproducts of dairy production systems is the male Brazilian dairy. It is often left to precarious comfort and animal welfare, becoming a problem for milk producers; on the other hand, when that is well established, this can become an alternative source of income and/or an important tool on the diversification process and acquisition of extra profit within a dairy farm (SANTOS, 2013).

Several authors (TEIXEIRA, 2000; MAGALHÃES, 2005) report good results to variables related to animal performance and carcass traits of dairy bulls. However, according to FREITAS NETO (2009), these animals do not have the ability to beef cattle, requiring effective nutritional management from the moment of birth, concomitantly with the adoption of technologies that promote optimal results in terms of performance and entail economic feasibility of the production system.

Among many existing nutritional technologies, in order to promote increased production, additive probiotics are composed by live yeast (*Saccharomyces cerevisiae*). Additives for animal feeding probiotics are prepared from micro-organisms cultures, among which the yeast stands out. These additives carried through in the ruminant gastrointestinal tract and it was not toxic nor left residues in carcasses intended for human consumption (NICODEMO, 2001; OYETAYO and OYETAYO, 2005). The live yeast (*Saccharomyces cerevisiae*) is the mechanism of action to help maintain the pH in the rumen via stimulation of lactate-using bacteria and contributes with constant nutrient supply to the bacterial population in the gut (ROSE, 1997).

Likewise, TRICARICO (2005) highlights the increase in animal productivity, regardless of the purpose of the production system, to be cut so as milk, through the use of yeast is a result of its ability to stimulate the proliferation of total anaerobic rumen bacteria, cellulolytic bacteria and lactic acid bacteria users in the rumen. These microorganisms, therefore, alter metabolism and improve the digestion of the fibrous portion of the diet. It is expected, hence, that the performance indices, among these, carcass characteristics, the animals supplemented with these additives are superior.

Carcass characteristics can be evaluated through measurable parameters which are related to their qualitative and quantitative aspects (MÜLLER, 1987). Among these characteristics, carcass yield is one of the main, understood as the ratio between the percentage of carcass weight and animal weight. On the other hand, according to GESUALDI JR. et al. (2000), the estimate of this income should be used in conjunction with other factors, among them the components that are not part of the carcass.

The non-integrant components of the carcasses, in turn, have great importance, since they are a revenue share of fridge. Moreover, it is clear the study of these components, because they influence so direct carcass yield and energy maintenance of the animal (PAZDIORA et al., 2009).

However, according to SAINZ (2010), the positive effects of probiotics on these performance variables mentioned above are not always observed

due to the inconsistency of results in the literature. There are several factors that influence this variability of results, among which it is worth mentioning: the concentration and combination of micro-organisms provided, animal category, diet types and forms of supply, making it necessary to study the effect of probiotics against different animal diets high in challenge. Thus, animals from dairy breeds at growing/finishing feedlot are examples of this type of animal.

The aim of this study was to evaluate the effect of dietary inclusion of probiotic (*Saccharomyces cerevisiae*) on the features and non-integrant components of the Holsteinsteerscarcasses finished in feedlot.

Material and Methods

The experiment was conducted on the premises of the Animal Production Center (NUPRAN), part of the Agricultural and Environmental Sciences Section at Universidade Estadual do Centro-Oeste (UNICENTRO) in Guarapuava - PR. The aim of this study was to evaluate the effect of dietary inclusion of probiotic (*Saccharomyces cerevisiae*) on the features and non-integrant components of the Holsteinsteers carcasses finished in feedlot. The experimental design was completely randomized with two treatments (diet with or without probiotic) and six replications. Each replicate was represented by a bay with two animals. The probiotic Kera Animal Nutrition Company, consisting of *Saccharomyces cerevisiae* KA_{500} ($2x10^{10}$ CFU g^{-1}) was fed to each animal at a dose of 10 g day^{-1}.

It was used 24 Holstein steers with initial age of 192 days and initial body weight of 221 kg with a standard deviation of 7 kg. The animals were housed in feedlot, distributed into 12 pens with semi-covered area of 15 m² each (2.5 mx 6.0 m) with concrete feeder and metallic drinker regulated by automatic buoy. The experiment lasted 210 days, of which 35 initial days for adaptation to the diets and experimental facilities and, sequentially, 175 days of evaluation. The animals were weighed after a fasting period of 12 hours at the beginning and ending of the trial period, with intermediate weighing every 35 days.

The experimental diet was composed of forage (corn silage:50% + oat hay: 50%) at a constant ratio 25% forage and 65% concentrate. The animals were fed twice a day at 6:00 and 17:30 hours, when the voluntary food intake was recorded daily by weighing the amount offered and leftovers from the previous day. The adjustment in the supply of different diets was performed daily, whereas a 5% surplus of dry matter offered in relation to consumption.

The concentrated mixture was prepared in the feed mill of Agrarian Cooperative located in the region of Entre Rios, Guarapuava - PR. In the concentratepreparation were used the following foods: soybean meal, soybean hulls, wheat bran, radicle malt barley, maize grain milled, corn germ, limestone, dicalcium phosphate, urea livestock, vitamin and mineral premix, and monensin sodium salt (40 mg kg^{-1}). On the analysis, the concentrated mixture used in the experimental diet had average percentage contents of dry matter 89.2%, crude protein 19.0%, ether layer 3.95%, crude fiber 9.0%, neutral detergent fiber 28.66%, acid detergent fiber of 13.15%, ash 7.35%, Na 0.5%, Ca 1.20% and P 0.5% based on the full dry matter.

Composite samples were made of corn silage, oat hay and concentrate each treatment during the period of feedlot. The samples of food were taken to a forced air oven at 55° C for 72 hours or until constant weight to determine the dry matter basis. The pre-dry samples were ground in a *Willey* type mill with a sieve of 1 mm diameter and subsequently conducted for chemical analysis (AOAC, 1995).

In the pre-dry samples it was quantified the total dry matter kiln and sterilization at 105º C, crude protein by the method micro Kjedahl, ash by incineration at 550° C and ether extract according to techniques described in AOAC (1995). The levels of neutral detergent fiber were obtained according to the method of VAN SOEST et al. (1991) with the enzyme α -amylase thermo-stable and acid detergent fiber in accordance with GOERING AND VAN SOEST (1970). Mineral nutrients were analyzed according to the methodology described by TEDESCO et al. (1995). The chemical analysis of food and experimental diet provided to confined animals is represented in Table 1.

At the end of the feedlot, following a fasting period of 12 hours, the animals were weighed before charging to the fridge, thus obtaining the weight of the farm. The slaughter followed the normal flow of a slaughterhouse. After slaughter, with the removal of the skin and evisceration of the 24 animals, carcasses were identified, washed and weighed, obtaining the hot carcass weight (MÜLLER, 1987).

Five measures of development were also

Table1. Average levels of dry matter, crude protein, neutral detergent fiber, acid detergent fiber, ash, Ca and P food and experimental diet provided to Holstein steers finished in feedlot.

Parameter	Commercial concentrate	Corn Silage	Oat hay	Experimental diet
Dry matter, %	92.94	32.82	93.15	68.99
Crude protein, % DM	19.84	6.43	6.17	15.37
Neutral detergent fiber, % DM	30.13	52.50	68.08	38.53
Acid detergent fiber, % DM	14.62	31.15	44.86	20.77
Ash, % DM	4.48	2.40	4.21	6.81
Ca, % DM	1.22	0.20	0.43	0.86
P, % DM	0.54	0.23	0.21	0.40

taken in the carcasses: carcass length, which is the distance between the edge of the medial cranial pubic bone and the cranial edge of the first medial rib; leg length, which is the distance between the edge of the medial cranial bone pubis and the tibio-tarsius; arm length, which is the distance between the olecranon tuberosity and the radio-carpiana;arm perimeter, obtained in the median region of the arm encircling with a tape; and the thickness of the cushion measured via compass direction perpendicular to the carcass length, taking the greatest distance between the cut that separates the two half-carcasses and lateral muscles of the thigh, according to the methodologies suggested by MÜLLER (1987).

At slaughter, it was also performed, in order to characterize the body parts that do not integrate carcass characteristics of steers slaughtered, the collection of the following components weight: head, tongue, tail, paws and leather (known as external components); heart, kidneys, liver, spleen and lungs (known as vital organs); rumen-reticulum filled, empty rumen-reticulum, abomasum full, empty abomasum, small and large intestines filled (known as digestive organs).

The collected data on the housing characteristics and on the components that are not part of the carcass were subjected to analysis of variance with comparison of means, the 5% significance level, through the SAS (1993).

Results and Discussion

The data in Table 2 show the values of the carcass characteristics of feedlot steers with or without probiotic addition. In analyzing the data, the inclusion of probiotic did not affect (P>0.05) carcass characteristics, represented by the parameters: live weight farm, carcass income, cold carcass weight, carcass length, cushion thickness, arm length, perimeter arm and leg length, with mean values of 427.5 kg, 50.45%; 215.5 kg; 135.95 cm, 19.1 cm, 42.5 cm, 40.25 cm and 79.65 cm, respectively. Fat thickness, on the other hand, had significant difference (P<0.05) between treatments, and the group that had the

Table 2. Carcass characteristics of feedlot steers fed with or without the addition of probiotic diets.

Parameter	Experimental diet		
	With probiotic	Without probiotic	Average
Liveweight of farm, kg	420 a	435 a	427.5
Income carcass, %	50.8 a	50.1 a	50.45
Cold carcass weight, kg	213 a	218 a	215.5
Carcass length, cm	135.9 a	136.0 a	135.95
Cushion thickness, cm	19.4 a	18.8 a	19.1
Arm Length, cm	42.4 a	42.6 a	42.5
Arm perimeter, cm	39.8 a	40.7 a	40.25
Leg length, cm	79.3 a	80.0 a	79.65
Fat thickness, mm	5.5 a	4.4 b	4.95

Means followed by lowercase letters, in line differ by F test at 5%.

addition of the probiotic in the diet had better finish housing, visualized by fat thickness (5.5 vs. 4.4 mm).

KUSS et al. (2009), who tested monensin, probiotic and an association between them about the diet of feedlot steers, had similar results to the present study. In this work, although they were used for cattle genotypes with higher fitness weight gain, there was no significant difference compared to the carcass characteristics with the inclusion of these additives. Treatment with the inclusion of additives association obtained fat thickness identical to the present study with measurement of 5.5 mm, and this value is within the limits required by the refrigerator (3-6 mm).

GOMES et al. (2009), in turn, evaluating 72 Nelore cattle fed with different additives, observed that the addition of yeast, although it has generated results in terms of carcass yield than the control group (56.9% vs. 55.9%), no significant result was obtained concerning carcass weight.

In a similar study, NEUMANN et al. (2013) found that the inclusion or not of yeasts on the performance and carcass traits of bulls Canchim 36 and confined Brangus, although the yeast has generated positive effect on the performance of these animals, it was found that there was no significant difference in *Saccharomyces cereviseae* on live weight farm variables, hot carcass weight, dressing percentage, carcass length, leg length and arm length, and similarly, about fat and cushion thickness.

On the other hand, in a study by RODRIGUES et al. (2013), using 29 Nelore, the inclusion of yeast in the diet of these animals led to slaughter a lower live weight of farm and consequently a lower carcass weight. Table 3 presents the average values of yield components not included in the carcass of feedlot cattle, fed with or without the addition of yeast.

In general data analysis, it is found that the inclusion of probiotic has not affected (P>0.05) the weight average heart (1.805 kg), liver (7.465 kg), lungs (5.615 kg), kidneys (1.215 kg), spleen (1.13 kg), rumen-reticulum filled (37.21 kg), rumen-reticulum empty (8.64 kg), filled abomasum (2.385 kg), empty abomasum (1.835 kg), full bowel (20.885 kg), head (10.91 kg), tongue (0.89 kg), leather (37.6 kg), tail (1.05 kg) and feet (9.925 kg).

There are several studies in the literature of components that are not part of housing (PAZDIORA et al., 2009; PACHECO et al., 2005; RESTLE et al., 2005) explaining their current importance. The relevance is

Table 3. Weights of the components are not part of the carcass of feedlot diets with or without probiotic addition.

Components	Experimental Diet		
	With Probiotic	**Without Probiotic**	**Average**
Vital organs:		**Kg**	
. heart	1.78 a	1.83 a	1.805
. liver	7.47 a	7.46 a	7.465
. lungs	5.66 a	5.57 a	5.615
. kidney	1.21 a	1.22 a	1.215
. spleen	1.25 a	1.01 a	1.13
Digestive organs:		**Kg**	
. Rumen / reticulum filled	38.13 a	36.29 a	37.21
. Rumen / reticulum empty	8.69 a	8.59 a	8.64
. Abomasum filled	2.32 a	2.45 a	2.385
. Abomasum empty	1.85 a	1.82 a	1.835
. Intestines filled	21.10 a	20.67 a	20.885
External components:		**Kg**	
. Head	11.11 a	10.71 a	10.91
. Tongue	0.89 a	0.89 a	0.89
. Leather	38.47 a	36.73 a	37.6
. Tail	1.10 a	1.00 a	1.05
. Paws	10.08 a	9.77 a	9.925

Means followed by lowercase letters, in line differ by F test at 5%.

justified by the fact that these elements are an income share of refrigerators, for marketing to industry byproducts and also for human consumption of offal. Moreover, these components likewise havea direct influence on carcass yield and also on the maintenance requirement of animals.

NEUMANN et al. (2013) evaluated the inclusion of live yeast on the components that are not part of carcass, evaluating the same parameters of this study and found no significant results. However, as there is a big shortfall regarding work evaluation of the use of yeasts on components of other members, it is necessary to develop more work in order to clarify these points.

Conclusion

The use of probiotic containing *Saccharomyces cerevisiae* strain KA_{500} ($2x10^{10}$ CFU g^{-1}), did not cause changes on the features and components that are not part of housing Holstein steers finished in feedlot.

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