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Short communication

The effect of an active live yeast product on the digestibility of finishing diets for lambs

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ABSTRACT

The influence of a rumen-specific active live yeast (*Saccharomyces cerevisiae*; *SC CNCM I-1077*), alone or in combination with an ionophore (Lasalocid-Na), on the apparent digestibility of nutrients in a standard lamb finishing diet was investigated. The four dietary treatments consisted of the same basal diet (151 g CP/kg DM, 226 g NDF/kg DM and 11.2 MJ ME/kg DM) differing only in respect to the additive included, i.e. (i) the control diet (C; no additive), (ii) live yeast (SC; 220 g/ton), (iii) lasalocid-Na (G; 120 g/ton) and (iv) both live yeast with ionophore (SCG) added at the same mentioned levels. Thirty-two South African Mutton Merino wethers (44.46 ± 3.84 kg) were randomly allocated to the four dietary treatments ($n = 8$ animals/treatment) and each placed in digestibility crates for a period of 16 days (7-day adaptation followed by a 9-day collection period). Dietary treatment had no effect ($P > 0.05$) on the apparent nutrient digestibility of the finisher diets. However, ionophore (G) inclusion significantly increased ($P < 0.01$) the digestible CP content (10.89% digestible CP) of the experimental diet. This effect was significantly enhanced ($P < 0.05$: 11.38% digestible CP) when a live yeast/ionophore combination (SCG) was included within the finishing diet. In contrast, including lasalocid-Na (G) within finishing diets of lambs significantly reduced ($P < 0.05$) its digestible EE content (5.71% digestible EE). The results suggest that this rumen-specific live yeast included alone, or in combination with lasalocid-Na, does not influence apparent digestibility or the ME content of finishing diets fed to lambs. It does however enhance apparent total tract CP availability.

1. Introduction

Metabolic modifiers are mainly included in ruminant diets to improve the efficiency and profitability of meat production (Dikeman, 2007). Carboxylic polyether ionophore antibiotics, produced by various strains of *Streptomyces spp.* are compounds of these rumen metabolic modifiers and include products such as monensin, lasalocid and salinomycin (Bergen & Bates, 1984). Apart from ionophore antibiotics' ability to depress methane production (*in vitro* and *in vivo*) via a direct effect on archae methanogens by shifting the fermentation pattern towards an increase in propionate at the expense of acetate (McDonald et al., 2002; Cheeke, 2005), a decreased degradation of protein and deamination of amino acids in the rumen is also recorded (Chen & Russell, 1991; Lana et al., 1997). Bergen & Bates (1984) and Nagaraja (1995) reported that the overall effectiveness of ionophores may

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vary depending on the dietary inclusion level, diet composition, and various inherent animal factors. An ionophore (monensin-Na) is however more effective in high-grain diets (Sauer et al., 1998).

The inclusion of probiotics in food is generally designed to encourage certain strains of microbes in the gut at the expense of the less desirable ones, unlike the destructive action of antibiotics. A probiotic is defined as a live microbial food supplement that beneficially affects the host animal by improving the intestinal microbial balance (McDonald et al., 2002). Rumen specific yeasts (*Saccharomyces cerevisiae*, one of the most common) are well accepted as a probiotic having beneficial effects in livestock production (Chaucheyras-Durand et al., 2008). The most important benefits include the improvement of rumen maturity by favoring microbial establishment (scavenging oxygen and maintaining anaerobic conditions; Newbold et al., 1996), stabilization of ruminal pH (reducing the risk of acidosis by competing with lactic acid producing bacteria) and increasing fiber degradation by stimulating the growth of cellulolytic bacteria (Wallace, 1994; Chaucheyras-Durand et al., 2008).

Cellulose and hemicellulose represents about 300 g/kg of most ruminant diets. These plant cell wall polymers are insoluble, structurally complex and not entirely physically accessible, which explains why their degradation is sometimes limited (McDonald et al., 2002). The host's enzymes are unable to hydrolyze this kind of molecule, which could enforce the use of a yeast culture in ruminant diets. Callaway & Martin (1997) reported that, with daily yeast culture supplementation, cellulolytic bacteria became established earlier and remained at a high and stable level even after a particularly stressful period.

Optimization of the rumen ecosystem can be achieved by combinations of live yeast products and other additives. Possible synergistic effects may manipulate microbial populations and activities even further (Chaucheyras-Durand et al., 2008). Combinations of yeast cultures with ionophores such as monensin or lasalocid have been investigated (Erasmus et al., 2005). Data available on feeding active dry yeast products to small ruminants is however limited (Titi et al., 2008), especially with regard to a rumen specific yeast supplemented alone or in combination with an ionophore antibiotic in finishing diets of lambs. Although complementary effects of several products may be theoretically of interest, there is no clear cut response from the available literature.

The aim of this study was therefore to evaluate the effects of a rumen-specific active live yeast (*Saccharomyces cerevisiae*; *SC CNCM I-1077*) alone or in combination with an ionophore antibiotic (lasalocid-Na) on the nutrient digestibility and digestible nutrient content of finishing diets fed to lambs.

2. Materials and methods

All procedures conducted during this study were approved by the Interfaculty Animal Ethics Committee for Animal Experimentation at the University of the Free State (Animal Experiment No. 08/09).

Table 1
Mean chemical composition of the four experimental diets used during the digestibility study.

Parameter	Treatment diets[a]			
	C	SC	G	SCG
Chemical composition (dry matter basis):				
Dry matter (%)	92.69	92.84	92.92	92.61
Organic matter (%)	91.73	91.25	91.82	90.56
Crude protein (%)	14.83	14.85	15.09	15.50
Ether extract (%)	6.21	6.67	5.98	6.36
Neutral detergent fibre (%)	22.03	23.25	22.53	22.47

[a] Treatments: C = Control diet (no additive included); SC = Rumen specific yeast (220 g/ton feed); G = Lasalocid-Na (120 g/ton feed); SCG = Rumen specific yeast with ionophore (included at 220 and 120 g/ton feed, respectively).

2.1. Treatment diets

Four dietary treatments were formulated and consisted of the same basal diet differing only in respect to the additive supplemented (Table 1), i.e. (i) the control diet (C; no additive), (ii) live yeast product (SC; *Saccharomyces cerevisiae*; *SC CNCM I-1077*; 220 g/ton), (iii) ionophore antibiotic (G; Lasalocid-Na; 120 g/ton – 33 mg active ingredient/kg feed) as well as (iv) the live yeast product and ionophore (SCG) included at the same levels as for treatments (ii) and (iii), respectively. The basal diet contained 250 g/kg hominy chop, 170 g/kg lucerne hay, 110.5 g/kg maize meal, 75 g/kg molasses, 70 g/kg citrus pulp, 64.5 g/kg maize germ meal, 50 g/kg maize cobs, 50 g/kg coconut oilcake, 50 g/kg fullfat soya, 30 g/kg soya hulls, 21 g/kg prime gluten, 20.5 g/kg fish meal, 10.5 g/kg limestone, 7.5 g/kg salt, 6 g/kg bicarbonate soda, 2.5 g/kg premix (containing the respective treatment additives), as well as 12 g/kg other additives. Each additive was included according its mean registered level as required by the Fertilizers, farm feeds, agricultural remedies and stock remedies act of South Africa (Act 36 of 1947).

The basal diet was formulated to obtain maximum live weight gain. The NRC (1985) nutrient requirements for finishing lambs in a feedlot were used as a guideline. After proper mixing each experimental diet was pelleted to minimize feed selection and losses that could affect the results of the study. Between treatments the whole mixing system was flushed with wheat bran to prevent contamination of the different additives.

2.2. Experimental animals

Thirty-two South African Mutton Merino wethers (44.46 ± 3.84 kg), approximately five months of age, were randomly allocated to the four dietary treatments ($n = 8$ animals/treatment), each representing a replicate and placed in digestibility crates.

All animals were subjected to a standard health and vaccination program four weeks prior to the onset of the production study, as practised in the commercial feedlot sector of South Africa. The vaccine used was a 7-in-1 Clostridial plus Pasteurella vaccine (Reg. No. G1517; Act 36 of 1947). All lambs were drenched against tapeworm (Reg. No. G447; Act 36/1947) and injected a broad spectrum parasite remedy (Reg. No. G1726; Act 36/1947) as well as a trace mineral optimizer (Reg. No. G1853; Act 36/1947). All lambs had free access to clean, cool drinking water.

2.3. Trial procedures

The digestibility study consisted of seven days adaptation, followed by a 9-day collection period. To minimise variation in assessing voluntary feed intake, a sequential method of feed allocation was followed by providing each lamb with a 15% refusal level of intake. Feed offered was calculated based on the moving average feed intake of the preceding three days. The lambs were fed twice daily. The faeces voided were collected twice daily (at 07h15 and 15h45). Daily composite feed and feed refusals (orts) of each animal were also collected. After thorough mixing, representative samples were obtained by means of the quartering method (McDonald et al., 2002). Feed, orts and faecal samples were analysed for dry matter (DM) and crude protein (CP) content according to official methods for chemical analysis (AOAC, 2000). Neutral-detergent fibre (NDF) (Van Soest et al., 1991) and gross energy (GE) (Cantrell et al., 2010) were