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Rumen Fermentation and Microbial Population of West African Dwarf Goat Fed Varying Level of Yeast (*Saccharomyces cerevisiae*)

O.O. Adelusi, C.F.I. Onwuka, A. Oluwasegun, K. Stephen, M. Salako, P. Chigbo, B. Okoidegun
Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Nigeria.
Corresponding author: O.O. Adelusi; E-mail: adelusioludotun@gmail.com

Abstract
A study was carried to evaluate the effect of yeast (*Saccharomyces cerevisiae*) rumen fermentation and microbial population of West African dwarf goat. Four (4) dietary treatments were prepared by adding 0 g, 0.5 g, 1.0 g and 1.5 g yeast to concentrate feed. Twelve (12) West African Dwarf goats (does and bucks) with an average live weight of 10.17±0.53 kg were allocated to the four treatment lots in a completely randomised design and used in a feeding trial. Concentratewas fed at 3% of body weight and *ad libitum Panicum maximum* as the basal diet. Data were collected on proportions of rumen volatile fatty acids (VFAs), ammonia nitrogen (NH_3-N), bacteria, protozoa, fungi, and analysed using one-way analysis of variance. Results showed that proportions of VFA and NH_3-N were not affected ($p>0.05$) by addition of yeast. Bacteria and fungi population were also not affected ($p>0.05$) by the inclusion of yeast, howeverthere was an increase ($p<0.05$) in protozoa from 0.73×10^9 (control) to 1.33×10^9 (1.0g yeast). It can be concluded that addition of yeast to the diets of goats did not affect overall rumen fermentation;however it led to an increased population of protozoa.

Keywords: Yeast, goats, rumen, microbes, volatile fatty acids.

Introduction

Digestive processes in the rumen can be manipulated through the addition of direct-fed microbialwhichenhances feed digestion, to improve the performance of animals and to boost the health status of animal (Robinson and Erasmus, 2009).The use of yeast (*Saccharomyces cerevisiae*) as a dietary supplement carried in a culture has been suggested as a useful tool to stabilize ruminal fermentation (William *et al*., 1991) and it has been found to have a number of effect in the rumen including increased pH, alteredvolatile fatty acids concentration, increased number of cellulotytic bacteria (William *et al*., 1991; Callaway and Martin, 1997) and increased rate or extent of ruminal fibre digestion (Callaway and Martin 1997). Yeasts and yeast products used in ruminant nutrition to manipulate rumen fermentation and improved animal performance have however yielded varied results in terms of performance. These differences may depend on many factors such as diet composition, forage to concentrate ratio, type of forage fed, yeast dose feeding strategy and stage of lactation several studies (Robinsonand Garrett, 1999). It has also been shown that live yeast and yeast culture supplementation may increase feed intake and milk production of dairy cows (Dann *et al*., 2000).

So this study thereforeevaluated the effect of varying level of yeast on rumen fermentation and microbiology of West African dwarf goat.

Materials and Methods

The experiment was carried out at the small ruminant unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture Abeokuta, Ogun State, Nigeria. Twelve (12) West African Dwarf goats (does and bucks) with an average live weight of 10.17±0.53 kg were used for the study. The goats were housed intensively in well ventilated pens with concrete floors. The experiment was set up as a completely randomized design (CRD) with four levels of yeast (0g, 0.5g, 1.0g, and 1.5g) added to the concentrate feed cassava peel (30%), dried brewers grain (34%), rice bran (30%), bone meal (4%) and salt (2%). Each treatment was having three (3) replicates each. Concentrate was given to the animals at 3% of their body weight and *Panicum maximum* as basal diet, while clean water was provided *ad libitum* intake. The feeding trial lasted for 70days.

At the end of the trial, rumen fluid was collected from each buck at 0 and 6 hours after feeding via the oesophagus through the use of a suction tube. About 100ml of rumen fluid was taken into aseptic tubes, filtered through four layers of cheesecloth, were divided into three parts, and kept in sample bottles for fermentation and microbial analyses. The determination of rumen ammonia nitrogen was carried out according to the method described by Lanyansunya *et al.* (2007). Volatile fatty acids(lactic acid, propionic, acetic and butyric acids) were determined by using the modified protocol of potentiometric titration system(Siedlecka *et al*., 2008).The second portion of the rumen fluid was

divided into two parts. A part was fixed with 10% formalin solution in sterilized 0.9% saline solution. The total direct count of bacteria, protozoa and fungal zoospores was made by the methods of Galyean (1989).

Data collected were subjected to analysis of variance as a completely randomized experiment using IBM SPSS (2011). The significant mean differences were compared by Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Table 1 shows the effect of adding yeast (*Saccharomyces cerevisiae*) to the diet of West African dwarf goats. The result shows that lactic acid, acetic acid, propionic acid, butyric acid and rumen ammonia nitrogen (NH_3-N)were not influenced ($p>0.05$) by the inclusion of yeast. This is in agreement with the study of Chedemama and Offer (1990) which reported that yeast does not influence volatile fatty acids concentration and fermentation pattern.Yeasts are chemo-organotrophs that utilize organic compounds as a source of energy, and this could mean that the extra volatile fatty acids generated through additional degradation by the probiotic yeast was utilized for their proliferation.Williams *et al.*(1991) clarified that through the degradation of lyotropic carbohydrates in the rumen, yeast cultures regulate the rate of fermentation, and also by stimulation of lactate-utilizing bacteria yeasts facilitate stabilization of the rumen pH and mitigate its frequent oscillations during the day. This can be responsible for the numerical increase observed in the amount of lactate in the rumen of the goats, however not significantly varied across the treatments. A sharper increase in the level of inclusion might see a different result in terms of significance as there would likely be more production of lactic acid as the number of lactate-utilizing bacteria increase, since probiotic generally contribute to the microbial balance of the gut (Antunovic *et al.,* 2005).

Table 1:Rumen fermentation of West African dwarf goat fed varying levels of yeast (*Saccharomyces cerevisiae*)

Parameters	0g Yeast	0.5g Yeast	1.0g Yeast	1.5g Yeast	SEM	P value
Lactic acid	1.01	1.14	1.28	1.22	0.06	0.476
Acetic acid	0.68	0.76	0.86	0.81	0.04	0.476
Propionic acid	0.45	0.51	0.57	0.54	0.03	0.476
Butyric acid	0.07	0.08	0.09	0.08	0.00	0.476
NH_3-N	3.46	3.57	2.55	3.35	0.22	0.382

The rumen ecology of WAD goats fed yeast is presented in Table 2. The results showed that bacteria and fungi population were not affected ($p>0.05$) by the treatment. However, the population of protozoa increased ($p<0.05$) with increment in the level of yeast inclusion up to 1 g (1.33×10^9).It has been reported that yeast culture stimulates growth of cellulolytic bacteria and improve anaerobiosis in the rumen (Wallace, 1994), and though truly there was a numerical increase in the rumen bacteria count of goats in this study, there was however, no sufficient variation among the treatments to ensure an agreement with observations recorded in this earlier report. The increase observed in rumen protozoa population as the dietary yeast increased is in agreement with the study of Plata *et al.* (1994) which reported that the protozoa values were elevated with the inclusion of*S. cerevisiae* in animal diet. In studies that obtained contrary observations, Angeles *et al*. (1995) reported a reduction in protozoa population while the numbers remain unchanged in the experiments conducted by Miranda *et al.* (1996).

Table 2: Rumen microbial population of West African dwarf goat fed varying levels of *Saccharomyces cerevisiae*

Microbes	0g Yeast	0.5g Yeast	1.0g Yeast	1.5g Yeast	SEM	p- value
Bacteria (cfu/ml $\times 10^{12}$)	0.50	0.73	1.10	0.80	0.09	0.200
Fungi, $\times 10^6$	0.03	0.00	0.00	0.00	0.01	0.168
Protozoa, $\times 10^9$	0.73^b	0.63^b	1.33^a	0.70^b	0.09	0.006

Conclusion and Recommendations

From the results of this study, it can be concluded that the addition of yeast to the diet of WAD goats did not affect the rumen fermentation parameters measured. Although bacteria and fungi population were also not affected by the inclusion of yeast, the increase observed in the protozoa population could have implications for methane production in the rumen. Further studies are therefore recommended to investigate higher levels of yeast inclusion and the interaction between yeast and protozoa with its bearing on methane production

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