DIGESTA CHARACTERISTICS AND NUTRIENT DIGESTIBILITY OF BROILERS FED *SACCHAROMYCES CEREVISIAE* IN VARIED CEREAL BASED DIETS

Kuka T.Tar[1], Adeleye O.O.[2], Ndubisi-Ogbona, L.C[3], Adetona A.[2]
[1]*Department of Animal Production Technology, Federal College of Agric. Ishiagu*
[2]*Department of Animal Science, University of Ibadan*
[3]*Department of Animal Science, Babcock University*
Kuka Timothy Tar: timtar1@gmail.com, 08064994051

Abstract
The effect of Saccharomyces cerevisae (SC) as supplemental protein and probiotics in different cereal based diets on digesta pH, viscosity, water retention and ileal nutrient digestibility were assessed in broiler chicks. 324 day old arbor acre broilers were randomly allotted to 9 treatments of 3 replicates with 12 birds each. Maize, sorghum and wheat based diets were formulated to contain 5% of a commercial SC product (Baker's yeast), 0% SC (-ve control) and 0.2% oxytetracycline (+ve control) respectively. 0.2% titanium dioxide as marker was added to the feed on day 25 of the study, on day 28, two birds per replicate were euthanized and digesta collected from duodenum, jejunum ileum and caeeca. Data obtained were analysed with ANOVA at p=0.05. Inclusion of Saccharomyces cerevisiae at 5% in different cereal based diets did not influence digesta characteristics (p>0.05). Crude protein digestibility significantly reduced from 73.57% to 57.38% in sorghum and 76.76 to 66.13% in wheat respectively. Dry matter digestibility was not affected (p>0.05). In conclusion, supplementation of Saccharomyces cerevisiae at 5% did not affect digesta characteristics as well as improve dry matter and Crude protein digestibility in this study.

Key words: Broiler chicks, yeast, digesta characteristics, digestibility, cereals.

Introduction

Withdrawal of antibiotics from poultry production has led to animal performance problems, increased feed conversion and a rise in incidence of subclinical necrotisis (Wierup, 2001; Dibner and Richard, 2005). Viable alternatives have been suggested to include: exogenous enzymes, Probiotics or Direct fed Microbials, Prebiotics, Organic acids, Phytobiotics, Immune modulators and yeast (O'Keefe, 2005). *Saccharomyces cerevisae* is considered for its valuable proteins, growth promoting activity and other vital nutrients to enhance performance (Daghir and Abdul-Baki, 1997; Habib *et al.*, 2012).

Saccharomyces cerevisiae **affects intestinal environment by: (a) Neutralization of certain bacterial toxins (Castagliuolo *et al* ., 1996). (b) Adherence of flagellate bacteria to the mannose receptors; these pathogens are eliminated through faeces without colonization (Griggs and Jacob, 2005). (c) Reinforcement of mucosal integrity and intestinal cells (Zhang *et al*., 2005). (d) Modulation of the immune system by stimulation of IgA response to pathogens (Qamar *et al*., 2001).** The unique adsorptive capacity of the yeast cell wall is employed to attenuate the effect of some groups of mycotoxin in order to promote growth. The cell wall consists of an inner cell wall fraction (beta-glucan) and an outer cell wall fraction (mannan-oligosaccharide) (MOS).

This experiment was designed to study the growth promoting activity of yeast *Saccharomyce cerevisiae* in different diet compositions (maize, wheat and sorghum) through nutrient digestibility and assess the influence of *Saccharomyces cervisiae* on digesta characteristics (pH, viscosity and water retention) in broiler chicks.

Materials and Methods

Experimental birds, housing, feeding and procedure

320 one day old Abor Acre broilers were randomly allotted to 9 treatments of 3 replicates with 12 birds per replicate in a complete randomised design. The birds were housed in pen units on deep litre system for a period of 28 days. Recommended vaccinations for broiler chicks were administered; feed and water were offered *ad libitum*.

Diets and Feeding

Diets were formulated based on NRC, (1994) nutrient requirement of broilers using Maize, sorghum and wheat. The diets contained Baker's yeast at 5% as a protein supplement and growth promoter, nine experimental diets were formulated from the selected grains with and without yeast or antibiotics. Diets without antibiotics and yeast served as negative control, and diets with antibiotics served as positive control.

Digesta collection

Two birds, randomly selected from each replicate per treatment were euthanized and the small intestine sectioned viz: duodenum, jejunum and

ileum. Intestinal content were pooled in to plastic cups with lids and placed on ice block in an insulated box before transferring to deep freezer pending further studies.

Digesta pH

The intestinal pH of the samples from various sections was taken immediately using a portable digital pH meter at room temperature.

Digesta Viscosity

Approximately 1g of digesta was homogenized with 2ml distilled water in centrifuge tubes and centrifuged at 12,000*g* for 10 min. The supernatant was withdrawn and its viscosity (in milipascal, mPas) determined at 28°C and 60rpm shear rate, using viscometer (model NDJ-8S).

Determination of water retention

The tubes with sediments were weighed after extraction of the supernatant then oven dried. The dry weight was subtracted from the initial weight.

Water retention = [weight of residue + tube – weight of dry residue + tube] x 100

Chemical analysis

Diets and digesta samples were analyzed for proximate composition AOAC, (2000), and concentration of titanium dioxide using spectrophotometer at 410nm. Digestibility was calculated as:

$$\text{Apparent Ileal Digestibility} = \left(1 - \frac{\text{marker in feed}}{\text{Marker in digesta}} \times \frac{\text{nutrient in digesta}}{\text{nutrient indigesta}}\right) \times 100$$

Statistical Analysis

Data obtained from the study were analysed with ANOVA procedure at 0.05 in GLM. Means were separated using Duncan Multiple Range Test.

Results and Discussion

Yeast has been reported to enhance nutrient utilization and performance in poultry production. Its growth promoting properties are said to be influenced by diet composition and other factors. Different grains are also reported to have different viscosities which produce viscous digesta in the gut leading to reduced nutrient digestion and utilization.

Digesta characteristic

Digesta viscosity and water retention in the various segments of the intestine were not significantly ($P>0.05$) affected by supplementation (Table 1). This was similar to the study of Veldman and Vahl (1997), who observed that differences in viscosity of wheat grains were not reflected in broiler digesta viscosity.

The intestinal pH from the various segments was not significant ($p>0.05$) except for duodenum in *sorghum-SC* (6.29), which differed ($P<0.05$) from *wheat+SC* (5.69). Differences observed in duodenal, pH were suggested to be as result of the diet and not supplementation.

Nutrient digestibility

Protein digestibility significantly ($P<0.05$) reduced in wheat and sorghum. These differences were attributed to both the cereals and supplement effect. The lowest digestibility was observed from *sorghum+SC*. This was not so with sorghum in other groups, as well as *maize+SC* and *wheat+SC* diets. Dry matter digestibility was not significantly affected ($p>0.05$) (Table 2).

Supplementation of yeast at 5% negatively influenced protein digestibility of maize sorghum and wheat based diets in broilers. This was contrary to the study of Oyedeji *et al,* (2008) who reported yeast to have increased protein retention in broilers chicks fed high fibre diets. Fructo-oligosaccharide extracted from yeast cell was also reported to increase mineral, starch and protein utilization in broilers (Woyengo *et* al., 2010).

Conclusion

Digestion and utilization of nutrients is reported to be affected by physicochemical factors of the diet such as viscosity, water retention capacity and pH. The effect of baker's yeast investigated in different cereal based diets on digesta characteristics and nutrient digestibility in broiler chicks was not statistically significant. Inclusion of *Saccharomyces cerevisiae* at 5% in maize, sorghum and wheat based diets did not influence digesta characteristics and dry matter digestibility of broiler chicks. Crude protein digestibility reduced with yeast supplemented diets in the various cereals based diets. Yeast in this study did not improve nutrient digestibility. Different cereal based diets also did not influence the activity of yeast on digesta characteristics and nutrient digestibility.

References

Association of Official Analytical Chemists (2000). Official methods of analysis, 17th edition. Association of OfficialAnalytical Chemists, Arlington, VA, USA

Castagliulo, I., Lacant, T., Nikulassa, S.T. and Pothoulakis, C. (1996). *Saccharomyces boulardii* protease inhibits *clostridium difficile* toxin A effects in the rat ileum. *Infect. Immum.*, 4(2):5225-5232

Daghir, N.J., Abdul-Baki, T.K.(1997). Yeast protein in broiler rations. *Poult. Sci. 56: 1836–1841.*

Dibner, J. J., and J. D. Richards (2005). Antibiotic growth promoters in agriculture: history and mode of action. Poult. Sci. 84: 634-643.

Griggs, J. P., and J. P. Jacob. (2005). Alternatives

to antibiotics for organic poultry production. *J. Appl. Poult. Res.* 14:750-756.

Habib A.S, Alireza A, Alireza L (2012). Possibilities of inclusion of Saccharomyces cerevisiae as replacement for fish meal or poultry meat by-product in broiler chicken diet. J Biol. Environ. Sci. 6(18), 249–251

O'Keefe, T. (2005). Digestive aids: A brave new world of nutrition. *Poultry international*, Pp 26-30

Oyedeji, J.O., H.I. Ajayi and T. Egere (2008). The Effects of Increasing Levels of Yeast Culture (Levucel SB) in a High Fibre-Diet on the Performance and Nutrient Retention of Broiler Chicks. *Asian Journal of Poultry Science, 2: 53-57.*

Qamar, A., Aboudola, S., Warny, M., Michetti, P., Pothoulakis, C., Lamont, J. T. & Kelly, C. P. (2001). Saccharomyces boulardii stimulates intestinal immunoglobulin A immune response to

Woyengo TA, Slominski BA, Jones RO. (2010). Growth performance and nutrient utilization of broiler chickens fed diets supplemented with phytase alone or in combination with citric acid and multicarbohydrase. Poultry Science, 89(10):2221-2229.

Zhang, A. W., B. D. Lee, S. K. Lee, K. W. Lee, G. H. An, K. B. Song, and C. H. Lee (2005). Effects of yeast (*Saccharomyces cerevisiae*) cell components on growth performance, meat quality, and ileal mucosa development of broiler chicks. *Poult Sci.* 84:1015-1021.

Veldman, A., and Van de Aar, P. J. (1997). Effects of dietary inclusion of a natural clinoptilolite (mannelite) on piglet performance. Agribiol. Res. 50: 289-294.

National Research Council (1994). Nutrient Requirements of Poultry. Ninth revised edition. National Academy Press, Washington D.C

Table 1: Digesta characteristics of broiler chickens fed different diets at starter phase [1]

	+SC			-SC			AB Control				Two-way ANOVA [2]		
	Maize	Sorghum	Wheat	Maize	Sorghum	Wheat	Maize	Sorghum	Wheat	SEM	Supl	Diet	Supl*Diet
VISCOSITY (mPas)													
Duodenum	0.22	0.08	0.09	0.16	0.29	0.08	0.14	0.11	0.04	0.03	NS	NS	NS
Jejunum	0.079	0.064	0.050	0.097	0.147	0.129	0.264	0.167	0.247	0.04	NS	NS	NS
Ileum	0.177	0.138	0.111	0.075	0.167	0.096	0.126	0.229	0.132	0.04	NS	NS	NS
PH													
Duodenum	6.09	5.95	6.17	6.21[a]	6.29[a]	5.67[b]	6.18	6.08	5.69	0.08	NS	*	NS
Jejunum	5.90	5.63	5.74	5.94	5.72	5.80	6.07	5.82	5.89	0.12	NS	NS	NS
Ileum	5.97	5.85	6.30	5.99	6.08	6.19	6.84	6.09	6.13	0.15	NS	NS	NS
Caeca	7.48	7.10	6.53	7.17	7.07	6.88	7.59	7.17	7.07	0.15	NS	NS	NS
WRC													
Duodenum	0.64	1.13	0.99	0.66	2.53	1.05	1.01	0.86	1.63		NS	NS	NS
Jejunum	2.25	2.07	1.59	2.09	2.43	2.25	2.67	4.24	2.45		NS	NS	NS
Ileum	2.06	2.56	1.81	2.12	1.52	2.51	1.87	1.45	2.07		NS	NS	NS

Table 2: Nutrient Digestibility of broiler chickens fed different diets supplemented with yeast at starter phase [1]

2	+SC			-SC			AB Control				Two-way ANOVA [2]		
	Maize	Sorghum	Wheat	Maize	Sorghum	Wheat	Maize	Sorghum	Wheat	SEM	Supl	Diet	Supl*Diet
Digestibility(%)													
Protein	77.31[a]	57.38[c]	66.13[b]	80.22[a]	75.33[a]	72.42[ab]	77.89[a]	73.57[ab]	76.76[a]	1.70	*	*	NS
Dry matter	77.95	76.67	72.36	90.10	83.07	80.85	86.92	75.69	83.83	1.83	NS	NS	NS

[1]Values within a row not having the same letter are significantly different; [2] P>0.05; *, 0.05>P>0.01; **, 0.01>P>0.001; ***, P<0.01;

NS: No significant difference; +SC: Saccharomyces supplementation; -SC: without saccharomyces supplementation; AB: Antibiotics control; Supl: Supplement; Supl*diet: Interaction between supplement and diet; WRC: Water retention capacity