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Yeast Culture (*Saccharomyces cerevisae*) Supplementation: Effect on the Performance and Gut Morphology of Broiler Birds

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Abstract - A total of ninety six day-old broiler chicks were used for this study. The birds were allotted to four dietary treatments in a completely randomized design. Each treatment had 3 replicates and there were eight birds per replicate. All birds were kept under the same managerial, environmental and hygienic conditions. The diets were formulated on isocaloric (3000.00kcal/kgME) and isonitrogenous (23.00% Crude Protein) levels. T1 (control), T2 (1g/kg yeast supplementation), T3 (1.25g/kg yeast supplementation), T4 (1.5g/kg yeast supplementation) were fed to the birds on each treatment. Data on performance (feed intake, weight gain and feed conversion ratio) and gut morphology were collected. Data were subjected to analysis of variance (ANOVA) procedure of SAS, 2010. No significant differences were observed in the weight gain of the birds in the treatments. However, birds fed T2 had the least significant feed conversion ratio (2.10kg) when compared with their counterparts on the T1 (2.34kg).

Keywords : *Broiler bird, yeast culture, gut morphology, nutrient absorption.*

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Yeast Culture (*Saccharomyces cerevisae*) Supplementation: Effect on the Performance and Gut Morphology of Broiler Birds

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Abstract - A total of ninety six day-old broiler chicks were used for this study. The birds were allotted to four dietary treatments in a completely randomized design. Each treatment had 3 replicates and there were eight birds per replicate. All birds were kept under the same managerial, environmental and hygienic conditions. The diets were formulated on isocaloric (3000.00kcal/kgME) and isonitrogenous (23.00% Crude Protein) levels. T1 (control), T2 (1g/kg yeast supplementation), T3 (1.25g/kg yeast supplementation), T4 (1.5g/kg yeast supplementation) were fed to the birds on each treatment. Data on performance (feed intake, weight gain and feed conversion ratio) and gut morphology were collected. Data were subjected to analysis of variance (ANOVA) procedure of SAS, 2010. No significant differences were observed in the weight gain of the birds in the treatments. However, birds fed T2 had the least significant feed conversion ratio (2.10kg) when compared with their counterparts on the T1 (2.34kg). The analysis of the ileum and jejunum showed that the villus height, cryptal depth, mucosa height and area of cryptal gland of birds fed T4 increased significantly ($p<0.05$) compared with birds fed T1. However, the result muscularis height showed that birds fed T3 had the highest mean value for ileum (403.71μm) and jejunum (396.84μm) while birds fed T1 had the lowest mean of 327.50 μm and 166.03 μm for ileum and jejunum respectively.

In conclusion, dietary inclusion of yeast culture at 1.5g/kg increased the growth performance and improved intestinal morphology and nutrient absorption.

Keywords : Broiler bird, yeast culture, gut morphology, nutrient absorption.

I. Introduction

Yeast microbes are probably one of the earliest domesticated organisms. People have used yeast for fermentation and baking throughout history. Studying the diversity of yeasts harboring the GIT of animals would be incomplete without consideration of the role that these microorganisms play for the host.

For a long time, yeast products have been successfully included in feed as natural growth promoters for animals and poultry. Many types of yeast have been fed to animals either in the form of yeast-fermented mash produced on farms, yeast by-products from breweries or distilleries, or commercial yeast products (Kemal *et al.*, 2001; Saied *et al.*, 2011). Yeasts are eukaryotic microorganisms classified in the kingdom Fungi. Yeasts are unicellular although some species with yeast forms may become multi-cellular through the formation of a string of connected budding cells known as pseudohyphae, or false hyphae, as seen in most molds. Yeast size can vary greatly depending on the species, typically measuring 3–4 μm in diameter although some yeasts can reach over 40 μm (Walker *et al.*, 2002). Most yeasts reproduce asexually by mitosis and many do so by an asymmetric division process called budding.

Saccharomyces cerevisiae also known "baker's yeast" is one of the most widely commercialized species and one of the effective adsorbents which is rich in crude protein (40-45%) and also rich in vitamin B complex, biotin, niacin, pantothenic acid and thiamin and its biological value is high (Reed and Nagodawithana, 1999). Whole yeast products or yeast cell wall components have been used to improve growth and affect the physiology, morphology and microbiology of the intestinal tract of turkeys (Bradley *et al.*, 1994; Hooge, 2004b; Sims *et al.*, 2004; Zdunczyk *et al.*, 2004; 2005; Huff *et al.*, 2007; Rosen, 2007b; Solis De Los Santos *et al.*, 2007; Huff *et al.*, 2010) and broiler chicks (Hooge, 2004a; Zhang *et al.*, 2005; Huff *et al.*, 2006; Rosen, 2007a; Yang *et al.*, 2008a,b; Morales-Lopez *et al.*, 2009).

Many researchers referred an advantage of culture yeast that are fed to animals as responsible for the production of vitamin B complex and digestive enzymes and for stimulation of intestinal mucosa immunity and increasing protection against toxins produced by pathogenic microorganisms (Sarker *et al.*, 1996; Martinez *et al.*, 2004; Silversides *et al.*, 2006). Some studies have confirmed that the effects of yeast culture could be an alternative to antibiotic-based drugs in feed for broiler chicks (Hooge *et al.*, 2003; Stanley *et al.*, 2004). It has been reported that feeding yeast to chicks improves body weight gain and feed:gain ratio (Bonomi and Vassia, 1978; Ignacio, 1995; Onifade *et al.*, 1999).

The aim of this study was to evaluate the effects of adding different levels of yeast culture to diets of

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broiler chicks on the performance characteristics and gut morphological integrity.

II. Materials and Methods

A total of ninety six day-old Arbor Acres strain broiler chicks were used for this study. The study was carried out at the Teaching and Research Farm of the University of Ibadan, Ibadan for a period of eight weeks. The birds were randomly allotted to four dietary treatments of 3 replicates each. Each replicate had eight birds.The experimental design was completely randomized design. The treatments were T1 (Control), T2 (1g/kg yeast supplementation), T3 (1.25g/kg yeast supplementation) and T4 (1.5g/kg yeast supplementa tion). All pens were bedded with wood shavings litter and equipped with feeders and drinkers. Fresh feed and fresh water were supplied *ad libitum*. Performance data (feed intake, weight gain and feed conversion ratio) were taken weekly. At 48 days of age, three birds from each replicate were slaughtered after 12 hours of fasting and samples of ileum and jejunum were taken. The specimens were fixed in 10% formalin after which they were dehydrated in 100% ethanol. The specimens were then cleared with xylene and embedded in paraffin. A microtome was used to make 5mm cuts that were mounted on glass slides and stained using the H and E (Haematoxyline and Eosin) method. Five readings each of villus height and crypt depth were taken per specimen. This was done with a light microscope (Olympus). Villus height was measured from the apical to the basal region which corresponded to the superior portion of the crypts. Crypts were measured from the basis until the region of transition between the crypt and the villus. All data were subjected to analysis of variance (ANOVA) using the general linear model (GLM of SAS) 2010

III. Results and Discussion

Table 1 : The Gross Composition of Experimental Diets.

Ingredient (Kg)	Starter	Finisher
Maize	58	56.5
Groundnut cake	21	18
Soybean Meal	14.6	19
Palmkernel Cake	1	0
Wheat	0	1.5
Fish	2	0
Bone	2.4	1.5
Oyster Shell	0	2.5
Premix (Broiler)	0.25	0.25
Salt	0.25	0.25
Lysine	0.25	0.25
Methionine	0.25	0.25
Total	100	100
Calculated Nutrient		
Crude Protein (%)	23	20.00
Metabolizable Energy (Kcal/Kg ME	3,019.27	3,000.00
Crude Fibre (%)	3.3	3.5

No significant differences were observed in the values of the weight gain of the birds on the different dietary treatments. This is in agreement with the findings of Al-Mansour *et al.* (2011). The authors reported that yeast levels did not significantly affect body weight gain. Significant differences were however observed the feed intake and feed conversion ratio values of the birds on the different dietary treatments. Birds fed T1 had the highest feed intake (3.09kg) and FCR (2.34kg) while birds fed T2 (1g/kg) had the lowest feed intake (2.47kg) and FCR (2.10kg). This is in agreement with reports by Gao *et al*. (2008). The authors supplemented yeast culture to broiler diets at the rate of 0, 2.5g/kg, 5g/kg and 7.5g/kg of feed. They reported that there was a quadratic effect of concentration of yeast culture on performance with the lowest concentration (2.5g/kg) being the most effective, however the improved growth performance with was not attributed to the increased feed consumption. In terms of feed conversion ratio, the results showed that birds fed T2 (1g/kg) and T4 (1.5g/kg) diet had better FCR than birds on the other treatments. The result of this research is similar to what was observed by Paryad and Mahmoudi (2008) when different levels of yeast culture was supplemented in the diet of broilers and improved body weight, feed intake and feed conversion ratio was observed at 1.5% yeast inclusion. Yeast culture contains yeast cells as well as metabolites such as peptides, organic acids, oligosaccharides, amino acids, flavor and aroma substances, and possibly some unidentified growth factors, which have been proposed to produce beneficial performance responses in animal production. In agreement with this study, beneficial effects of yeast culture on performance were also observed in broiler chicks (Zhang et al., 2005). Other studies, however, reported that yeast products had no effect on performance in turkey poults (Bradley and Savage, 1995) and early weaned pigs (White et al., 2002). Differences in animal response may be related to differences in product formulations: yeast products are interchangeably classified as active dried yeast, live YC, or fermented YC as reported by Gao *et al*. (2008).

Table 2 : Performance characteristics of broilers fed diets supplemented with different levels of yeast.

Parameters (Kg)	T1 (Control)	T2 (1g/kg)	T3 (1.25g/kg)	T4 (1.5g/kg)	SEM
Initial Weight	0.26	0.27	0.27	0.27	0.006
Final Weight	1.58	1.44	1.49	1.49	0.028
Weight Gain	1.32	1.17	1.22	1.23	0.027
Feed Intake	3.09[a]	2.45[b]	2.75[ab]	2.69[ab]	0.097
FCR	2.34[a]	2.10[b]	2.23[ab]	2.18[ab]	0.032

[ab] Means with different superscript on the same row are significantly different ($p<0.05$)

SEM- Standard Error of Means, T- Treatment, FCR- Feed Conversion Ratio

Table 3 shows the morphological indices of broilers fed different levels of yeast. The results showed an increase in villus height, cryptal depth, mucosa height and area of cryptal gland with increasing level of yeast supplementation where birds fed T4 had the highest mean value. However, the result for the muscularis height showed that birds fed T3 had the highest mean for both ileum (403.71μm) and jejumun (396.84μm) while those on T1 had the lowest mean of 327.50μm and 166.03μm for ileum and jejunum respectively. From this result it can be deduced that increase in the villus height suggests an increased surface area capable of greater absorption of available nutrients (Caspary, 1992). Likewise, greater villus height increases the activity of enzymes secreted from the tip of the villi resulting in improved digestibility (Hampson, 1986). Cell wall components of yeast may provide a protective function to mucosa by preventing pathogens from binding to villi and allowing fewer antigens to be in contact with the villi. Taller villi indicate more mature epithelia and enhance absorptive function due to increased absorptive area of the villus. The better performance observed in birds fed T4 could be due to the increase in the villus height which resulted into increased absorption of available nutrients.

It can therefore be concluded that adding supplemental yeast to the diets of broiler birds at 1.5g/kg will improve the performance gut integrity and nutrient utilization.

Table 3 : Gut Morphology of Broilers fed diets supplemented with different level of yeast.

Parameters (μm)	T1 (Control)	T2 (1g/kg)	T3 (1.25g/kg)	T4 (1.5g/kg)	SEM
Ileum					
Villus Height	491.36[ab]	456.61[b]	557.86[a]	566.60[a]	13.84
Cryptal Depth	336.80[b]	282.52[c]	317.93[bc]	456.47[a]	9.15
Muscularis Height	327.50	388.99	403.71	369.87	22.21
Mucosa Height	697.97[b]	526.21[b]	719.09[b]	1178.28[a]	43.69
Area of Cryptal Gland	13570.00[a]	6098.50[b]	6712.50[b]	7382.00[b]	362.50
Jejunum					
Villus Height	703.77[a]	452.44[b]	533.28[b]	500.51[b]	21.72
Cryptal Depth	582.10[a]	585.76[a]	352.95[b]	508.46[a]	20.48
Muscularis Height	277.77[b]	396.84[a]	304.92[b]	166.03[c]	8.65
Mucosa Height	248.76[a]	890.07[b]	903.07[b]	822.71[b]	43.28
Area of Cryptal Gland	11843.00	8123.00	9456.00	9772.00	873.77

References Références Referencias

1. Bonomi, A. and G. Vassia, 1978. Observations and remarks on the use of *accharomyces cerevisiae* and *Kluyveromyces fragilis*, in the form of living yeast, on the production and quantiqualitative characteristics of broilers.Arch. Vet. Ital., 29(Suppl.): 3-15.
2. Bradley, G.L., T.F. Savage and K.I. Timm, 1994. The effects of supplementing diets with *Saccharomyces cerevisiae* var. *boulardii* on male poult performance and ileal morphology. Poult. Sci., 73: 66-70.
3. Caspary,W.F.1992, Physiology and pathophysiology of intestinal absorption. *Am. J. Clin. Nutr*. 55, 299S-308S.
4. Gao, J., H. J. Zhang, S. H. Yu, S. G. Wu, I, Yoon, J. Quigley, Y. P. Gao and G. H. Qi (2008). Effects of yeast culture in broiler diets on performance and immune-modulatory functions. Poultry Science 87: 1377 – 1384.
5. Hampson, D.J., 1986. Alterations in piglet small intestinal structure at weaning. Res. Vet. Sci., 40: 32-40.
6. Hooge, D.M., M.D. Sims, A.E. Sefton, A. Connolly andP.S. Spring, 2003. Effect of dietary mannanoligosaccharide, with or without bacitracin orvirginiamycin, on live performance of broiler chickens at relatively high stocking density on new litter. J. Appl. Poult. Res., 12: 461-467.
7. Hooge, D.M., 2004a. Meta-analysis of broiler chickenpen trials evaluating dietary mannan oligo-saccharide, 1993-2003. Int. J. Poult. Sci., 3: 163-174.
8. Hooge, D.M., 2004b. Turkey pen trials with dietarymannan oligosaccharide: Meta-analysis, 1993-2003. Int. J. Poult. Sci., 3: 179-188.
9. Huff, G.R., W.E. Huff, N.C. Rath and G. Tellez, 2006. Limited treatment with 4-1,3/1,6-glucan improves production values of broiler chickens challenged with *Escherichia coli.* Poult. Sci., 85: 613-618.
10. Huff, G.R., W.E. Huff, N.C. Rath, F. Solis de los Santos, M.B. Farnell and A.M. Donoghue, 2007. Influence of hen age on the response of turkey poults to cold stress, *Escherichia coli challenge* and treatment with a yeast extract antibiotic alternative. Poult. Sci., 86: 636-664.
11. Huff, G.R., W.E. Huff, M.B. Farnell, N.C. Rath, F. Solis de los Santos and A.M. Donoghue, 2010. Bacterial clearance, heterophil function and hematological parameters of transport-stressed turkey poults supplemented with dietary yeast extract. Poult. Sci., 89: 447-456.
12. Ignacio, E.D., 1995. Evaluation of the effect of yeast culture on the growth performance of broiler chick. Poult. Sci., 74(Suppl. 1):196. (Abstr.).
13. Kemal, C.K., M. Denl and O. Ozturkcan, 2001. The effects of *Saccharomyces cerevisiae* and flavomycin on broiler growth performance. Pak. J. Bio. Sci., 4:1415-1417.
14. Martinez, A.C., C.M. Parsnons and S.L. Noll, 2004. Content and relative bioavailability of phosphorus in distillers dried grains with solubles. Poult. Sci., 83: 1891-1896.
15. Morales-Lopez, R., E. Auclair, F. Garcia, E. Esteve-Garcia and J. Brufau, 2009. Use of yeast cell walls; $- 1,3/1,6-glucans and mannoproteins in broiler chicken diets. Poult. Sci., 88: 601-607.
16. Onifade, A.A., A.A. Odunsi, G.M. Babatunde, B.R. Olorede and E. Muma, 1999. Comparison of the supplemental effects of *Saccharomyces cerevisiae* and antibiotics in low-protein and high-fiber diets fed to broiler chicken. Arch. Anim. Nutr., 52: 29-39.
17. Paryad, A and M. Mahmoudi (2008). Effect of different levels of supplemental yeast (*Saccharomyces cerevisiae*) on performance, blood constituents and carcass characteristics of broiler chicks. African Journal of Agricultural Research. Vol. 3 (12). 835 – 842.
18. Reed, G. and T.W. Nagodawithana, 1999. Yeast Technology (2nd Edn.),Van Nostrand Reinhold, New York (Cited from Pakistan J. Bio. Sci.).
19. Rosen, G.D., 2007b. Holo-analysis of the efficacy of Bio-Mos in turkey nutrition. Br. Poult. Sci., 48: 27-32.
20. Saied, J.M., Q.H. Al-Jabary and K.M. Thalij, 2011. dietary supplement yeast culture on production and hematological parameters in broiler chicks. Int. J. Poult. Sci., 10: 376-380.
21. S. Al-Mansour, A. Al-Khalf, I. Al-Homidan and M.M. Fathi, 2011. Feed efficiency and blood Hematology of broiler chicks given a diet supplemented with yeast culture. Int. J. Poult.Sci., 603-607.
22. Sarker, S., L. Mandal, G. Dbanerjee and S.S. Sarker,1996. Comparative efficiency of different types of yeasts on the performance of broilers. In. Vet. J., 73:224-226.
23. Sims, M.D., K.A. Dawson, K.E. Newman, P. Spring and D.M. Hoogell, 2004. Effects of dietary mannan oligosaccharide, bacitracin methylene disalicylate, or both on the live performance and intestinal microbiology of turkeys. Poult. Sci., 83: 1148-1154.
24. Silversides, F.G., T.A. Scott, D.R. Korver, M. Afsharmanesh and M. Hrubys, 2006. A study on the interaction of xylanase and phytase enzymes in wheat-based diets fed to commercial white and brown egg laying hens. 85: 297-305.
25. Solis De Los Santos, F., A.M. Donoghue, M.B. Farnell, G.R. Huff, W.E. Huff and D.J. Donoghue, 2007. Gastrointestinal maturation is accelerated in turkey poults supplemented with a mannan-oligosaccharide yeast extract (Alphamune). Poult. Sci., 86: 921-930.
26. Stanley, V.G., C. Gray, M. Daley, W.F. Krueger and A.E. Sefton, 2004. An alternative to antibiotic-based

drugs in feed for enhancing performance of broilers grown on *Eimeria* sp.-infected litter. Poult. Sci., 83: 39-44.

27. Walker K, Skelton H, Smith K. (2002). "Cutaneous lesions showing giant yeast forms of *Blastomyces dermatitidis*". *Journal of Cutaneous Pathology* 29 (10):616–618.doi:10.1034/j.1600-0560.2002.29 1009 .x. PMID 12453301.
28. White, L. A., M. C. Newman, G. L. Cromwell, and M. D. Lindemann.2002. Brewers dried yeast as a source of mannan oligosaccharides for weanling pigs. J. Anim. Sci. 80:2619– 2628.
29. Yang, Y., P.A. Iji, A. Kocher, E. Thomson, L.L. Mikkelsen and M. Choct, 2008b. Effects of mannan-oligosaccharide in broiler chicken diets on growthperformance, energy utilization, nutrient digestibility and intestinal microflora. Br. Poult. Sci., 49: 186-194.
30. Yang, Y., P.A. Iji, A. Kocher, L.L. Mikkelsen and M. Choct, 2008a. Effects of mannanoligosaccharide and fructooligosaccharide on the response of broilers to pathogenic *Escherichia coli* challenge. Br. Poult. Sci., 49: 550-559.
31. Zdunczyk, Z., J. Juskiewicz, J. Jankowski and A. Koncicki 2004. Performance and caecal adaptation of turkeys to diets without or with antibiotic and with different levels of mannan-oligosacharide. Arch. Anim. Nutr., 58: 367-378.
32. Zdunczyk, Z., J. Juskiewicz, J. Jankowski, E. Biedrzycka and A. Koncicki, 2005. Metabolic response of the gastrointestinal tract of turkeys to diets with different levels of mannan-oligosaccharide. Poult. Sci., 84: 903-909.
33. 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.