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Effect of Baker's Yeast (*Saccharomyces cerevisiae*) Inclusion in Feed and in Drinking Water on Performance of Broiler Birds

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Author's Contributions

This work was carried out in collaboration between authors. Author FBO wrote the research protocol, designed the study, carried out the study, wrote the first draft and the literature search. Authors KUA and FOA managed the analyses. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aim: This study was designed to investigate the effect of Baker's yeast (*Saccharomyces cerevisiae*) inclusion in feed and in drinking water on the performance of broiler birds.
Study Design: Yeast in feed and in drinking water were laid out in Completely Randomized Design while yeast in water/feed was a factorial experiment (2 factors: level and route of application) with 5 application levels. Each study was replicated 3 times.
Place and Duration of Study: The study was carried out at the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria. The study lasted for 8 weeks.
Material and Methods: 450 Anak broiler chicks were used for the study. 150 chicks each for yeast in feed, yeast in drinking water and in feed/drinking water. Graded levels (0.5g $kg^{-1}l^{-1}$, 1.0g $kg^{-1}l^{-1}$, 1.5g $kg^{-1}l^{-1}$ and 2.0g $kg^{-1}l^{-1}$ of feed and drinking water given *ad libitum* only by day to chicks and through the finisher phase. They were fed broiler starter during the starter period and broiler finisher during the finisher period. They were allowed to run together on deep litter for acclimatization before separation into 5 groups with 3 replications each. Feed was fed by day only while drinking water was given *ad libitum.* Diets were formulated using Excel feed formulation and feeding models [1] and analyzed using Association of Official Analytical Chemists [2] while all data were analyzed using

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Statistical Package for Social Sciences [3].
Results: Broiler birds that received yeast supplementation in feed performed better than those with supplementation in water. Supplementation in both feed and water had no additive effect. Best results were in yeast inclusion levels of 1.0g yeast in feed and in drinking water.There was no interaction in yeast fed in water and in feed and therefore has no additive effect.
Conclusion: Best results were in yeast inclusion levels of 0.5g and 1.0g. This study recommends 0.5g yeast inclusion in feed.

Keywords: Yeast; performance; yeast inclusion and anak broiler.

1. INTRODUCTION

To meet poultry products requirements of Nigerians, there is the need to expand the industry. This goal according to [4] depends to a large extent on the availability of good quality feed in sufficient quantity and affordable prices that farmers could afford. According to [5], the cost of poultry feed has been on the increase and could constitute up to 80% of the total production cost. Yeast (*Saccharomyces cerevisiae*) appears potentially useful as it has been shown to improve feed digestibility and meat colour [6]. Yeast has also been reported as a feed quality enhancer as it has anti-microbial properties [7] and may be a good alternative to antibiotic growth promoters [8]. Live yeast augments digestive processes by initiating the process of fermentation, and a source of digestive enzymes of various kinds. The survivability of live yeast in chicken intestine is well established.

Saccharomyces cerevisiae is considered one of the live microorganisms that when administered through the digestive tract have a positive impact on the host health through its direct nutritional effects [9]. Yeast boosts immune level resulting in a better protection against infections [10]. The benefits of *Saccharomyces cerevisiae* to the immune system and on coccidial infection have been reported [11]. Likewise, [12] and [13] had reported its beneficial effect on Newcastle disease.

Sccharomyces cerevisiae has unidentified growth factor or unidentified growth ('plus') factor l14]. Yeast could therefore be a performance enhancer through improvement in protein utilization and a significant retention of crude fibre, thus confirms yeast as possessing the ability to degrade fibrous materials in poultry feeds. Ordinarily, poultry lack the enzymes (cellulases, hemi-cellulases and xylanases) to digest high fibre diets [15]. A number of researches has been conducted using enriched-yeast in livestock [16] and in poultry, non-enriched yeast has been used [6] and in fish [17]. [18] also reported that fermented yeast extracts are rich in mannan-oligosaccharides, β-gluccans and other nutritional metabolites that may optimize gut health and immunity, which translates to better growth performance and lower risks of disease-borne pathogens. Glucans extracted from *Saccharomyces cerevisiae* (baker's yeast) is one such type and is an important structural element of the yeast cell wall. Yeast glucans are polysaccharides composed of smaller units linked together by β-1,3 bonds. These bonds hold the glucan molecule together, hence the name, β-1,3 glucan. The mode of action of β-1,3 glucan is that there is a specific receptor for β-1,3 glucan on the surface of macrophages that when activated, stimulates a cascade of events turning the body into "an arsenal of defense". There is now evidence to show that glucan is, from an evolutionary point of view, the most widely and commonly observed macrophage activator in nature and is proven to overcome the negative effects of immunosuppression [19].

This study was conducted using non-enriched (Angel white label[R]) yeast to investigate the effect of yeast (*Saccharomyces cerevisiae*) as feed and water additive on the performance of broiler chickens.

2. MATERIALS AND METHOD

This study was carried out in the Teaching and Research Farm of Michael Okpara University of Agriculture Umudike, Nigeria using 450 Anak broiler chicks of mixed sexes as Nigeria does not sale broiler birds as separate sexes. Graded levels (0.5g $kg^{-1}l^{-1}$, 1.0g $kg^{-1}l^{-1}$, 1.5g $kg^{-1}l^{-1}$ and 2.0g $kg^{-1}l^{-1}$ of feed and drinking water given *ad libitum* only by day to chicks and through the finisher phase. The treatments were replicated thrice with 30 chicks per replicate. Performance parameters weighted and recorded daily were daily feed intake and daily weight gain. Daily protein intake (%CP * Daily feed intake), feed conversion ratio (Feed intake/Weight gain), protein efficiency ratio (Daily weight gain/Daily protein intake) were calculation and recorded while mortality was by counting. Diets were formulated using Excel feed formulation and feeding models [1], (Table 3.1). Proximate chemical analysis of diets were conducted using the methods of the Association of Official Analytical Chemists (Tble 3.2), [2]. All data were analyzed using Analysis of Variance [20] and means separated using Duncan's Multiple Range test [21] using Statistical Package for Social Sciences [3].

Table 3.1 Starter and fisher diets compositions

Ingredients (%)	Broiler Starter	Broiler Finisher
Maize (%)	50.00	50.00
Soybean (%)	33.00	28.00
Palm kernel cake (%)	14.00	18.00
Bone meal (%)	3.00	3.00
Sodium chloride (%)	0.25	0.25
Total (%)	100.00	100.00
Calculated analysis		
Crude protein (%)	22.04	20.56
ME/MJ/KG	14.45	14.67

This is with the protein and energy level as recommended [22].

Table 3.2 Proximate chemical analysis of Starter and finisher diets

Ingredients	Broiler Starter	Broiler Finisher
Crude protein (%)	22.15	20.1
Ether extract (%)	3.8	4.5
ASH (%)	7.51	7
Crude fibre (%)	3.8	5
Nitrogen free extract (%)	52.74	54.4
Metabolisable energy (MJ/KG)	14.45	14.67

Vitamin/mineral premix supplying Vitamin A (1500 IU), Vitamin D3 (1600 IU),Riboflavin (9.0mg), Biotin (0.25mg), Pantothenic acid (11.0mg), Vitamin K (3.0mg), Vitamin B2

(2.5mg), Vitamin B6 (0.3mg), Vitamin B12 (8.0mg), Nicotinic acid (8.0mg), Iron (5mg), Selenium (0.01mg), Magnesium (10.0mg), Zinc (4.5mg) and Cobalt (0.02mg) / Kg.

3. RESULTS AND DISCUSSION

All finisher broilers that had yeast supplementation in feed had significantly (P<0.05) higher daily weight gain and final live weight than those not supplemented (the control) group as shown in Table 3.3. Daily live weight gain was similar in the birds that had 0.5g and 1.5g; and in those had 1.0g and 2.0g yeast inclusion in feed but highest in 1.0g yeast inclusion group. Daily feed intake and protein efficiency ratio followed the same pattern with significantly (P<0.05) higher feed intake recorded by birds fed 1.0g yeast in feed than those supplemented with 0.5g, 1.5g and 2.0g yeast and the control.. No significant (P>0.05) difference existed between birds fed 0g, 1.0g, 1.5g and 2.0g yeast in feed efficiency ratio, protein efficiency ratio and mortality. Daily protein intake was of the same pattern with daily feed intake where the 1.0g yeast had the highest protein intake.

Table 3.3 Effect of yeast inclusion in feed on the performance of Broiler finisher

Parameters	0.0g	0.5g	1.0g	1.5g	2.0g	SEM
Initial live weight (g)	115.33	166.00	166.00	166.00	166.00	0.23
Final live weight (g)	1957.66^{b}	2184.67^{a}	2297.33^{a}	2174.33^{a}	2270.33^{a}	36.91
Daily weight gain (g)	50.67^{b}	56.06^{ab}	60.13^{a}	55.97^{ab}	56.06^{ab}	1.14
Daily feed intake (g)	112.29^{b}	118.08^{ab}	127.18^{a}	123.52^{ab}	117.4^{ab}	2.01
Feed conversion ratio	2.23	2.11	2.12	2.2 0	1.99	0.04
Daily protein intake (g)	22.57^{b}	23.73^{ab}	25.56^{a}	24.83^{ab}	23.60^{ab}	0.04
Protein efficiency ratio	2.25	2.38	2.36	2.25	2.52	0.05
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

a,b Means within the same rows with the same superscripts not significantly (P>0.05) different. SEM = Standard error of mean.

The improved performance could be attributed to beta-glucans which has growth promoting and immune-enhancing effects in broiler chickens [23]. This could also be attributed to carry-over effect of yeast supplementation at the starter phase. These results agree with [24], who reported significant improvement in body weight gain and feed conversion ratio in chicks fed live yeast (Sc47) and [25], who reported that up to 200mg of yeast per kg diet improved feed efficiency of broilers; as the final weights of the starter birds affected the finisher phase.

Table 3.4 Performance of finisher birds fed graded level of yeast in water

Parameters	0.0g	0.5g	1.0g	1.5g	2.0g	SEM
Initial Liveweight (g)	115.33	113.00	110.33	112.67	131.33	3.59
Final Liveweight (g)	1957.0^{b}	2182.66^{a}	2152.33^{a}	1986.00^{b}	1906.67^{b}	33.53
Daily Weight Gain (g)	50.67^{abc}	56.13^{a}	55.64^{ab}	50.10^{bc}	48.55^{c}	1.04
Daily Feed Intake(g)	114.54^{c}	123.30^{a}	120.64^{ab}	116.00^{bc}	116.17^{bc}	1.03
Feed Conversion Ratio	2.27	2.20	2.17	2.32	2.39	0.04
Daily Protein Intake (g)	23.02^{c}	24.78^{a}	24.25^{ab}	23.32^{bc}	23.35^{bc}	0.21
Protein Efficiency Ratio	2.20	2.26	2.30	2.15	2.08	0.04
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

a,b,c: Means within the same rows with the same superscripts are not significantly (P>0.05) different. SEM = Standard error of mean.

The performance of finisher broilers fed graded levels of yeast in drinking water is presented in Table 3.4. Broilers fed 0.5g yeast in water had significantly ($P<0.05$) higher daily weight gain , daily feed intake and final and live weight than those fed 0g, 1.5g and 2.0g yeast in drinking water. Daily protein intake also followed exactly the same pattern with daily feed intake while there were no significant ($P>0.05$) differences among the finisher broilers fed graded levels of yeast in feed conversion ratio and protein efficiency ratio.

This could also be attributed to the effect of oligosaccharides in yeast that enhances gut health with improved performance. This result also agrees with [23], who reported that diets with supplemental *Saccharomyces cerevisiae* at 0.025, 0.05 and 0.1% contain beta-glucans which has growth promoting and immune-enhancing effects in broiler chickens.

Table 3.5 Effect of yeast inclusion in feed/water on the performance of broiler finishers

Parameters	0.0g	0.5g	1.0g	1.5g	2.0g	SEM
Initial live weight (g)	105.16	100.33	100.49	100.19	101.00	0.44
Final live weight (g)	1957.66^{b}	1908.85^{c}	2006.62^{a}	1966.37^{ab}	1956.41^{b}	22.81
Daily live weight gain(g)	50.67	51.66	56.29	55.22	54.75	0.82
Daily feed intake (g)	132.29	130.06	138.37	135.11	135.87	1.53
Feed conversion ratio	2.59	2.52	2.46	2.46	2.48	0.03
Daily protein intake (g)	26.71	26.14	27.81	27.16	27.31	0.31
Protein efficiency ratio	1.92	1.99	2.02	2.03	2.01	0.03
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

^{a,b}*Means within the same rows with the same superscripts are not significantly (P>0.05)*
SEM = Standard error of mean.

The performance of finisher broilers fed yeast supplementation in feed/drinking water is presented in Table 3.5. Broilers fed 1.0g yeast in water had significantly ($P<0.05$) higher final live weight than those supplemented with 0g, 0.5, 1.5g and 2.0g yeast in feed/drinking water. The yeast treated groups of 1.5g and 2.0g were statistically different from the control and those that received 0.5g yeast. Daily live weight gain, Daily feed intake, feed conversion ratio, Daily protein intake, protein efficiency ratio and mortality were not significant ($P>0.05$) differences among the finisher broilers supplemented yeast inclusion levels in drinking water.

This report disagrees also with [26], who reported that yeast supplementation at the starter phase is more effective for promoting feed conversion and body weight gain than that applied at the finisher phase of broiler production.

Interaction between route and level of yeast application in broiler water and feed is presented in Table 3.6. There was no interaction in all the performance parameters studied due to application of yeast in water and in feed. This results could be attributed to no additive effect due to the simultaneous application of yeast in water and feed. This could be attributed to excess alcohol production due to excess yeast intake. This agrees with [27] which reported that yeast provides a better solution to the problem of recycling NADH, through the enzyme *pyruvate decarboxylase* (A). This converts pyruvate to acetaldehyde by releasing CO_2, which is a non-acidic product. Acetaldehyde can then be reduced to ethanol by *alcohol dehydrogenase* (B), which consumes NADH and releases NAD+ so that glycolysis can continue.

Results also agree with [28], who reported that both granular and powdery forms of live yeast have no growth stimulatory effects in male broiler**.** This result disagrees with the reports of [25], who reported that up to 200mg of yeast per kg diet improved feed efficiency of broilers.

Table 3.6 Interaction between route of administration and level of yeast inclusion on broiler finisher performance

Parameter	Route	0g	0.5g	1.0g	1.5g	2.0g	Mean
Final live weight gain (g)	Water	1957.67^{b}	2297.33^{a}	2270.33^{a}	2182.67^{a}	1986.00^{b}	2138.8
	Feed	2184.67^{a}	2174.33^{a}	1957.00^{b}	2152.3^{ab}	1906.67^{b}	2074.9
	Mean	2071.17	2235.83	2113.67	2167.49	1946.34	
	SEM	= 27.73	R=20.54;	L=32.47;	RXL =	45.93	
Daily live weight gain (g)	Water	50.67^{bcd}	60.13^{a}	59.16^{a}	56.13^{ab}	50.10^{cd}	55.24
	Feed	56.06^{ab}	56.97^{ab}	50.67^{bcd}	55.64^{abc}	48.55^{d}	53.58
	Mean	53.37	58.55	54.92	55.89	49.33	
	SEM	=0.85 ;	R =0.80;	L= 1.27;	RXL =	1.80	
Daily feed intake (g)	Water	112.29^{d}	127.18^{a}	117.40^{bc}	123.30^{ab}	116.00^{bc}	119.23
	Feed	118.07^{abc}	123.52^{ab}	114.54^{bc}	120.64^{abc}	116.17^{bc}	118.59
	Mean	115.18	125.35	115.97	121.97	116.09	
	SEM	=1.12;	R =1.30;	L= 2.05;	RXL =	2.91	
Feed conversion ratio	Water	2.23^{ab}	2.12^{ab}	1.99^{b}	2.20^{ab}	2.32^{a}	2.17
	Feed	2.11^{ab}	2.21^{ab}	2.27^{ab}	2.17^{ab}	2.39^{a}	2.23
	Mean	2.17	2.17	2.13	2.19	2.36	
	SEM	=0.03	R =0.04;	L=0.06 ;	RXL =	0.09	
Daily protein intake (g)	Water	22.57^{c}	25.56^{a}	23.60^{bc}	24.78^{ab}	23.34^{bc}	23.97
	Feed	23.73^{abc}	24.83^{ab}	23.02^{bc}	24.25^{abc}	23.35^{bc}	23.84
	Mean	23.15	25.20	23.32	25.52	23.34	
	SEM	= 0.22;	R =0.26;	L= 0.41;	RXL =	0.58	
Protein efficiency ratio	Water	2.25^{ab}	2.36^{ab}	2.52^{a}	2.26^{ab}	2.15^{b}	2.31
	Feed	2.38^{ab}	2.25^{ab}	2.20^{ab}	2.30^{ab}	2.08^{b}	2.24
	Mean	2.32	2.31	2.36	2.28	2.12	
	SEM	= 0.03;	R =0.04;	L=0.07 ;	RXL =	0.10	

^{a,b,c,d} Means on the same row with the same superscripts are not significantly (P>0.05) different.
SEM = Standard error of mean: R = Route of application: L = Level of application.
RXL = Interaction SEM.

4. CONCLUSION

Birds that were supplemented yeast in feed had better performance than those with supplementation in water. Yeast in water and feed had no interaction and no additive effect. This study recommends the inclusion of 1.0g baker's yeast in feed at the finisher phase.

COMPETING INTERESTS

Authors declare that there are no competing interests.

REFERENCES

1. Onwurah FB. Excel feed formulation and feeding models. Indian J. of Education and Information Management. 2011;1(2):88-92. Available online at: http://www.iseeadyar.org/ijem.html
2. Association of Official Analytical Chemists Official methods of analysis, 17th edition. Association of Official Analytical Chemists, Arlington, VA, USA. 2000.
3. SPSS SPSS 15.0 for windows Evaluation version. 2006. Available on www.spss.com
4. Babatunde BB, Hamzat RA. Effect of feeding graded levels of kolanut husk meal on the performance of cockerels. Nigerian Journal of Animal Production. 2005;(32)1:61-66.
5. Ibiyo LM, Atteh JU. Response of starter broilers to diets containing graded levels of rice bran with or without palm oil. Nigerian Journal of Animal production. 2005;(32)1:39-45.
6. Ezema C, Ezejimbe CC, Eze DC, Kamalu TN. Effect of probiotic (*Saccharomyces cerevisiae*) on digedtibility and growth rate of pullets fed Palm Kernel Cake based diet. A paper presented at the 34th A nnual Conferrence of the Nigerian Society of Animal Production at the University of Uyo, Nigeria. 2009;344-346.
7. National Livestock Research Institute Use of yeast to reduce antibiotic use in broiler raising. Food and Technology Administration Centre. Retreived from mhtml: file: \\User\ONWURAH\Desktop\Document\use of yeast to reduce anti; 2007.
8. Shen YB, Piao XS, Kim SW, Wang L, Liu P, Yoon I, Zhen YG. Effects of yeast culture supplementation on growth performance, intestinal health, and immune response of nursery pigs[1]. J. Anim. Science. 2009;87:2614-262
9. Patterson JA, Bulkholder KM. Application of prebiotics and probiotics in poultry production. Poult. Science. 2003;82:627-631.
10. Panda AK, Reddy MR, Rama RV, Raju MV, Paraharaj NK. Growth, carcass characteristics, immunocompetence and response to Escherichia coli of broiler fed diets with various levels of probiotics. Archives fur Geflugelkunde. 2000;64:152-156.
11. Gao J, Zang HJ, Yu SH, Wu SG, Yoon JQ, Gao, YP, Qi GH. Effects of yeast culture in broiler diets on performance and immunomodulatory functions. Poult. Science. 2008;87:1377-1384.
12. Jeannine PG, Wooley RE, Emmett BJ, Dickson JA. Viricidal effect of *Lactobaccillus* and Yeast fermentation. American Society for Microbiology. Available on-line at: http://intl.aem.ams.org; 2012.
13. Silva, VK, Della TJ, De Fario Filho DE, Torres KA, Hirota Hada F, Barbosa de Moraese VM. Humoral immune system system response of broilers fed diets containing yeast extract and prebiotics in the prestater phase and raised at different temperatures. Poult. Sci. 2012;91:393-401.
14. Paryard A, Mahmoudi M. Effect of different levels of supplemental yeast (Saccharomyces cerevisiae) on performance, blood constituents and carcass characteristics of broiler chicks. African Journal of Agricultural Research. 2008;3(12):835-842.
15. Oyedeji JO, Ajayi HI, Egere T. The effect of increasing levels of yeast culture (Levucel SB) in a higher fibre-diet on the performance and nutrient retention of broiler chicks. Asian J. Poultry Science. 2008;2:53-57. Available: http://www.iseeadyar.org/ijeim.html
16. Downs KM, Hess JB, Bilgili SF. Selenium source effect on broiler carcass characteristics, meat quality and drip loss. J. Appl. Anim. Research. 2012;18,61–72. DOI:101080/09712119.2000.9706324.

17. Aghdamshahriar H, Nazer-Adl K, Ahmadzadeh. The effect of yeast (*Saccharomyces cerevisiae*) in replacement with fish meal and poultry by-product protein in broiler diets. Islamic Azad University, Iran. 2006.
18. Pelicia VC, Sartori JR, Zavarize KC, Pezzato AA, Stradiotti AC, Araujo PC, Mituo MA, Madeira LA. Effect of nucleotides on broiler performance and carcass yield. Brazilian Journal of Poultry Science. 2010;12(1):31-34.
19. FISON/WINROCK workshop, Abuja. Nigeria. 2013.
20. Steel, RGD and Torrie, JH. Principles and Procedures of Statistics. Biometrical Approach (2nd ed.). McGraw-Hill Book Co. New York; 1980.
21. Duncan DB. Multiple range and multiple F-test. Biometrics II: 1955;1-42.
22. Oluyemi JA, Robert FA. Poultry production in warm wet climates. 4th ed. Nigeria MacMillian Press Ltd; 2000.
23. Park CW, Grimes JL, Ferket PR, Fairchild AS. The effects of mannan oligosachharides, bambermycins, and virginamycins on performance of large white male market turkeys. Poult. Science. 2001;80:718-723.
24. Ghasemi HA, Tahmasbi GH, Moghaddam M, Mehri S, Alijani E, Kashefi E, Fasihi A. The effect of phytase and *Sachharomyces cerevisiae* (Sc47) supplementation on performance, serum parameters, phosphorous and calcium retention of broiler chickens. International Journal of Poultry Science. 2006;5(2):162-168.
25. Raju MV, Reddy VR, Rama SV, Panda AK. Yeast: A multifunctional feed supplement for poultry. A review of benefits of yeast in poultry diets. Poult. International. 2006;45:16-21.
26. Adejumo DO, Onifade AA, Olutunde TO, Babatunde GM. The effects of concentration, age and duration of feeding supplemental yeast (Levucel SB) in a higher fibre diet on the performance of broiler chickens. J. Sus. Trop. Agric. Res. 2005;13:58-65.
27. Chem*4570 Applied Biochemistry Lecture 2- Production of ethanol by yeast. Available on line at: www.chembio.uoguelph.ca/edumat/chm457/4570L2.pdf.
28. Gheisari AA, Kholeghipour B. Effect of dietary inclusion of live yeast (*Sachharomyces cerevisiae*) on growth performance, immune response and blood parameters of broiler chickens. Azad university, Iran. (n.d).
    Available online at: www.cabl.org/animalscience/uploads/file/Animalscience/.

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