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The Effects of Increasing Levels of Yeast Culture (Levucel SB) in a High Fibre-Diet on the Performance and Nutrient Retention of Broiler Chicks

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Abstract: One hundred and sixty (160) one day old Ross 355 broiler chicks were used in an experiment to determine the effects of supplementing brewer's dried grain with Levucel SB yeast. Four experimental diets were used. Diet 1 which served as control had 0.0 mg kg^{-1} dietary inclusion level of yeast. Diets 2, 3 and 4 which had higher level of brewer's dried grain were supplemented with 200, 250 and 300 mg of yeast per kg of diet respectively. Feed and water were supplied *ad libitum*. The experiment lasted for four weeks. Results at the end of the experiment showed that, feed intakes were not significantly affected by yeast supplementation. However, live weight gains and feed conversion ratios of broilers fed diets with yeast supplementation were significantly improved ($p<0.05$). Cost of feeding to 4 weeks of age was also significantly reduced for these groups of broilers ($p<0.05$). Dietary yeast supplementation did not affect broiler livability. Results of nutrient retention trial showed that while protein and fat retentions were comparable among broilers in all groups whereas fibre retention was significantly increased by yeast supplementation ($p<0.05$). It was concluded that, Levucel SB yeast fed at either 250 or 300 mg kg^{-1} to supplement 26% inclusion of brewer's dried grain in broiler starter diet could enhance body weight gain, feed conversion and fibre retention. In addition, such supplementation could also result in lowering cost of feeding.

Key words: Broilers, starter diet, Levucel SB, weight gain, feed conversion, feed intake, fibre retention

INTRODUCTION

Protein and energy components of broiler starter ration are high. With the use of traditionally costly feed ingredients such as maize and soybean meal, the cost of producing starter ration also becomes high. Costs of feeding broilers could be reduced with the use of less costly feed ingredients such as industrial by products. One of such by products is brewer's dried grain. Brewer's dried grain is high in metabolisable energy and crude protein and hence could be used to reduce quantity of maize and soybean used in broiler ration. Brewer's dried grain usage is however limited in monogastric animals because of its high fibre (24% ADF) content, so it is not normally used in intensive feeding system.

Chickens are monogastrics and do not possess the enzymes needed to digest high fibre diets. For this reason, it has been difficult and uneconomical to substitute very cheap high fibre ingredients like rice bran, wheat offal and brewer's dried grain for the regular ingredients like maize which are relatively costly.

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Helping the chicken to extract more nutrients from feedstuffs is not new. Atteh and Leeson (1985) showed that supplementary cholic acid enhanced fat retention in broiler chicks fed diets high in saturated fatty acids.

Several researchers found benefits in the use of yeast (Onifade *et al*., 1999; Onifade, 1997; Bradley *et al*., 1994), amino acids (Braude *et al*., 1972), herbs and herbal extracts/green feeds (Best, 2000) in their feed formulations. In broiler and swine rations, the use of appropriate feed additives offers an opportunity to overcome some of these potential limitations imposed by exclusively vegetable protein-based diets which tend to contain more fibre than animal protein sources and poultry are known to be poor in digesting fibre (Longstaff and McNab, 1989). Yeast (*Saccharomyces cerevisiae*) has been traditionally used as growth promoters in poultry and other animals. Various researches on yeast have indicated that supplementation of yeast in diet is effective in improving growth and feed efficiency in broilers. Yeasts primarily targeted at grain or grain by-product components of the diets will have both direct and indirect benefits on the digestibility of vegetable proteins and fibrous matter in the ration. Indirect benefits can arise when yeasts and metabolic enzymes breakdown the fibrous and nutrient components of the ration (Adejumo *et al*., 2005).

Adejumo *et al*. (2005) 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. However, only two levels of supplementation 50 and 100 mg kg^{-1} of diet were employed in their study. Raju *et al*. (2006) reported that up to 200 mg yeast per kg of diet improved feed efficiency of broilers. In an attempt to determine the optimum level of yeast supplementation, this study was designed to investigate the effects of three different levels of yeast supplemented brewer's dried grain in broiler starter diets on chicks' performance and nutrient retention. A positive effect could help in reducing the cost of feeding broiler chicks during the starter phase.

MATERIALS AND METHODS

One hundred and sixty, one day old Ross 355 broilers chicks of mixed sex were housed in an electrically fitted battery brooder cage. Unit size of cage was 3021 cm^2 with each unit fitted with one 90 watts bulb to provide the necessary warmth for brooding. The chicks were allocated into four treatment groups each replicated four (4) times with 10 chicks per replicate. The study was conducted when the average daily temperature was about 32°C and tropical day length averaging 12 h. The study took place at Benson Idahosa University Teaching and Research Farms where four different broiler starter diets (diet 1, 2, 3 and 4) were formulated (Table 1) using the ingredients purchased from reputable dealers. Diet 1 which served as control did not contain yeast supplement whereas diets 2, 3 and 4 contained 200, 250 and 300 mg kg^{-1} of diet respectively. The yeast used was Levucel SB, a commercial yeast culture (*Saccharomyces cerevisiae*) manufactured by Agrimerica Inc. and Lallemand Inc. in Illinois, USA. In diets 2, 3 and 4 brewer's dried grain level was increased to 26.03 kg as against 14.0 kg used in the control diet 1, resulting in higher fibre contents in the former.

Chicks were divided into four treatment groups. Four trials were conducted using 40 chicks per trial. In each trial, 10 chicks were allotted for each treatment group. Feed and water were made available *ad libitum* to broiler chicks throughout the four weeks of data collection. Data on feed intake, body weight gain and mortality were taken at weekly intervals. Finally at the end of 4 weeks live weights of broilers were taken.

A nutrient retention trial was carried out at the 3rd week using total collection method. Quantities of feed consumed by broiler chicks in each group were determined over 72 h. Fecal samples were also collected over the same period. The fecal samples were dried in an oven at 80°C, weighed and milled prior to chemical analysis. Proximate analyses of feed and fecal samples were carried out using the method of AOAC (1990).

Table 1: Percentage composition and nutrient contents of broiler starter diets used in the experiment

	Diet composition (mg yeast kg^{-1} diet) in 0-4 weeks			
Ingredients	0	200	250	300
Maize	44.03	30.00	30.00	30.00
Soybean meal	30.84	25.52	25.52	25.52
Brewer's dried grain	14.00	26.03	26.03	26.03
Fish meal	1.50	1.50	1.50	1.50
Palm kernel cake	2.50	8.53	8.53	8.53
Palm oil	3.58	4.87	4.87	4.87
Bone meal	2.69	2.69	2.69	2.69
Snail shell	0.26	0.26	0.26	0.26
Salt	0.25	0.25	0.25	0.25
Vitamin mineral premix*	0.25	0.25	0.25	0.25
DL-methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Nutrient contents				
Moisture content (%)	96.85	96.68	97.01	96.54
Crude protein (%)	22.77	22.82	22.95	22.98
Ether extract (%)	4.37	5.62	5.60	5.65
Crude fibre (%)	4.63	7.28	7.15	7.35
Metabolisable energy (kcal kg^{-1})	3198.00	3201.00	3201.00	3201.00
Lysine (%) (calculated)	1.16	1.11	1.11	1.11
Methionine (%) (calculated)	0.48	0.54	0.54	0.54
Cysteine (%) (calculated)	0.34	0.34	0.34	0.34
Arginine (%) (calculated)	1.50	1.57	1.57	1.57
Tryptophan (%) (calculated)	0.32	0.33	0.33	0.33

*: Supplied kg^{-1} diet: Vitamin A (8000iu), vitamin D3 (1,200iu), vitamin E (31iu), vitamin K3 KASTAB (2 mg), vitamin B2 Nicotinic acid (10 mg), vitamin B5 Pantothenic acid (150 mg), Manganese (Mn) (80 mg), Zinc (Zn) (50 mg), Copper (Cu) (2 mg), Iodine (I) (1.2 mg), Cobalt (Co) (2 mg), Selenium (Se) (0.1 mg)

The data collected were subjected to the analysis of variance as described by Steel and Torrie (1980) for a completely randomized design. Significant differences in means were separated using Duncan Multiple range test (Duncans, 1955).

RESULTS AND DISCUSSION

Table 2 shows the effect of yeast supplementation on the feed intake, weight gain, feed to gain ratio, percentage mortality and cost of feeding during starter phase. Results at the end of four weeks showed that feed intakes among chicks were not significantly influenced ($p>0.05$). However, live weight gains and feed conversion ratios of chicks fed supplemental yeast were significantly increased ($p<0.05$). Also, cost of feeding was significantly reduced for these groups of broilers during the starter phase ($p<0.05$). Percentage mortality of chicks was not significantly affected ($p>0.05$).

The results of the nutrient retention trial is as shown in Table 3. Crude protein and crude fat retentions were comparable among broiler chicks irrespective of the level of yeast supplementation ($p>0.05$). Crude fibre retention on the other hand was significantly increased among chicks fed on yeast supplemented diets than those on zero supplementation that is the control ($p<0.05$).

The results on performance indices of broiler chicks confirm the growth promoting property of yeast in poultry. Ignacio (1995) reported that yeast has been traditionally used as growth promoter in poultry and other animal diets. The results in many ways agree with earlier works (Onifade, 1997; Adejumo *et al*., 2005). Earlier workers attributed parts of the growth promoting properties of yeast to its ability to stimulate feed intake by improving palatability (Wallace and Newbold, 1992; Ignacio, 1995).

Table 2: Effect of yeast supplementation on the performance and cost of feeding broilers (0-4 weeks)

Levucel SB yeast concentration (mg kg^{-1} diet)	Feed intake (g/bird)	Weight gain (g/bird)	Feed gain ratio	Mortality (%)	Cost of feeding (N/bird)
0	530.00	380.00^{b}	1.40^{a}	8.33	24.34^{a}
200	510.00	430.00^{ab}	1.19^{ab}	4.17	20.85^{ab}
250	540.00	480.00^{a}	1.13^{b}	0.00	22.02^{ab}
300	500.00	460.00^{a}	1.09^{b}	0.00	20.38^{b}
SEM	3.98	6.14	0.25	1.85	1.24

**Means within column carrying different superscripts differ significantly ($p<0.05$)

Table 3: Effect of Yeast supplementation on nutrient retention by broiler chicks

Levucel SB yeast concentration (mg kg^{-1} diet)	Crude protein (%)	Crude fat (%)	Crude fibre (%)
0	65.63	82.27	40.63^{b}
200	64.39	83.28	54.82^{a}
250	66.32	81.60	58.21^{a}
300	66.18	82.61	59.95^{a}
SEM	7.61	6.06	5.28

Means within column carrying different superscripts differ significantly ($p<0.05$)

In this study, yeast, especially at 250 and 300 mg kg^{-1} supplementation at the starter phase promoted higher body weight gains and better efficiency in nutrient utilization than the diet without yeast supplementation. This was however without a significant effect on feed intake. Earlier published results had shown similar trends. For example, Charlie (1998) reported that supplementation of 2-3 g yeast kg^{-1} diets is effective in improving growth and feed efficiency in broilers. Also, Adejumo *et al*. (2005) reported that yeast supplementation at 100 mg kg^{-1} at the starter phase promoted body weight gain and feed conversion without significant effect on feed intake. The Levucel yeast used in this study is a yeast culture which is a complex mixture and extra cellular fermentation metabolites (enzymes, vitamins, various nutrients and co factors). It has been observed that the positive effects of yeast are more apparent on nutrient retention (Raju *et al*., 2006). The nutrient retention values in this study seem to confirm yeast as a performance enhance especially that of protein. Also, the significant retention value of crude fibre confirms yeast as possessing the ability to degrade fibrous materials in poultry feeds. Ordinarily, poultry lacks the enzymes such as cellulases, hemi cellulases and xylanases needed to digest high fibre diets. Presumably, it thus appears that yeasts primarily targeted at grain or grain by-product components of the diets will have both direct and indirect benefits on the digestibility of vegetable proteins and fibrous matter in the ration. Adejumo *et al*. (2005) reported that indirect benefits of yeasts can arise when yeasts and metabolic enzymes breakdown the fibrous and nutrient components of the ration.

Yeast inclusion in the starter diet especially at 300 mg kg^{-1} supplementation seems to promote livability of broiler chicks as evidenced by zero mortality. This results agree with earlier workers. For example, Raju *et al*.(2006) reported reduced mortality due to non specific aetiology in broiler flocks with inclusion of yeast in their feed. Best (2000) also reported that some plant extract exhibited antibacterial properties when used as feed additives for pigs. Incidentally, the use of antibiotic as a feed additive is currently being restricted, in such a situation, yeast may offer an effective alternative.

The reduction in cost of feeding observed in this study showed that, supplementary yeast aided fibre digestion and nutrient utilization of cheap, high fibre brewer's dried grain, making it an economical substitute for the costly, scarce, high energy maize in broiler starter diet. Charlie (1998) on cost analysis for broiler production stated that when birds were fed with high protein diets, the extra value of the birds receiving yeast culture equaled $ 0.3959 resulting in 9:1 returns on investment.

In conclusion, Levucel SB yeast culture offers a number of potential advantages as a feed supplement for broilers during the starter phase as demonstrated in this study. Its inclusion at either 250 or 300 mg kg^{-1} dietary levels will enhance weight gain and feed conversion ratio as well as reduce

cost of feeding. Therefore, it is recommended that Levucel SB yeast as used in this study could be added as a feed supplement when high fibre diet is formulated for broiler chicks.

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