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The Effect of Supplementing *Saccharomyces cerevisiae* in the Diets on Egg Laying and Egg Quality Characteristics of Pullets

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Abstract: A trial was carried out to evaluate the effect of supplementing *Saccharomyces cerevisiae* - containing dried yeast (SDY) in the feed on performance, external and internal egg quality characteristics of pullets and the cost effectiveness of the various levels of substitution. The SDY was included in the pullet feeds at 5 levels of 0. 00, 0.25, 0.50, 0.75, 1.00%. Brown hypeco pullets were used. The chemical analysis indicated that the SDY used was high in dry matter (DM) (96.39%), crude protein(CP) (59.09%), and crude fibre (CF) (11.65%). The trial was conducted for 18 weeks starting from point of lay. No significant ($P>0.05$) differences were observed in the performance parameters except feed conversion efficiency (FCE) where 0.75% SDY inclusion had the best FCE of 2.16. Egg weight, shell weight, yolk weight and height were higher ($P<0.05$) and Haugh unit better in 0.75% SDY fed pullets. The gross benefit derived from the supplementation was superior in 0.75% SDY fed birds compared to the control birds. The observed results were attributed to better feed conversion efficiency (FCE) of 0.75% SDY group, possibly due to its better supply of phytase phosphorus and bio- availability of certain micro-nutrients.

Key words: *Saccaromyces cervisiae*, diet, egg quality characteristics, pullets

Introduction

One of the major challenges facing the poultry industry in the developing world is about improving efficiency of production. To meet this challenge and maintain efficient feed utilization, series of attempts have been made by researchers. These include incorporation of anti-microbials and other natural products, such as Direct feed Microbials (DFM) into animal feeds (Kung, 1992; Muihead, 1992).

In this direction, Patrick and Schaible (1980) reported that fortification of grains with yeast if conducted in proper proportion makes a superior feeding material. Live yeast addition to animal feed has been known to improve the nutritive quality of feed and performance of animals (Glade and Sist, 1988; Martin *et al*., 1989). Dried yeast (SDY) from malted grain fermentation constitutes a natural concentrate mixture of essential nutrients. SDY has biologically valuable proteins combined with high potency vitamin B-complex, important trace minerals and several unique "plus" factors. Many other beneficial attributes of yeast has been identified such as ability to increase digestion in horses (Glade and Biesik, 1986; Brake, 1991; Moore *et al*., 1994) enhancement of phosphorus availability and utilization by animals (Thayer *et al*., 1978; Erdman, 1989; Pagan, 1990), reduction in cases of disease infection (Line *et al*., 1997), improvement of feed efficiency (Day, 1997; Onifade and Babatunde, 1996). Santin *et al*. (2001) reported that mannanoligosaccharides and fruct-Oligosaccharides in the cell wall of yeast , such as *Saccharomyces cerevisiae* by maintaining or re-establishing the conditions of eubiosis in the digestive tube, assist the balance of the gastro-intestine . Some authors (Hayat *et al*., 1993, Bradley and Savage, 1993) have attributed the increase in mineral retention and better bone mineralization of broilers to mannanoligosaccharide prebiotic.

However, there are still conflicting reports on the beneficial effect of yeast inclusion in poultry diets. This situation made Hayat *et al*. (1993) suggested that the beneficial effects of SDY in feeds may be influenced by the birds genome and recommended further studies. In spite of these series of studies on the effect of yeast inclusion in animal diets no one has come out with the specific effect of *Saccharomyces cerevisiae* on egg production and egg quality characteristics of pullets. This work therefore, has the objective of evaluating the supplemental effect of *Saccharomyces cerevisiae* on egg production and egg quality characteristics of pullet birds.

Materials and Methods

Feed preparation: Five different layer's feed were formulated and fed to the pullets. The control diet had no *Saccharomyces crervisiae* while diets T2, T3, T4, and T5 contained *S. cerevisiae* at 0.25, 0.5, 0.75, and 1.00 % levels. Yellow maize, fish meal and groundnut cake served as the main energy and protein sources. These ingredients were ground with hammer mill to pass through 0.02mm diameter sieve and were then mixed together in machine mixer. The composition of the experimental diet is shown in Table 1.

Table 1: Composition of the experimental diets (%)

	Dietary yeast levels (%)				
Ingredients	T1	T2	T3	T4	T5
Dried yeast	0.00	0.25	0.50	0.75	1.00
Yellow maize	50.00	49.75	49.50	49.25	49.00
Groundnut cake	20.00	20.00	20.00	20.00	20.00
Rice bran	13.85	13.85	13.85	13.85	13.85
Oyster shell	2.00	2.00	2.00	2.00	2.00
Bone meal	7.00	7.00	7.00	7.00	7.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Table salt	0.50	0.50	0.50	0.50	0.50
Palm oil	2.00	2.00	2.00	2.00	2.00
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
*Premix	0.20	0.20	0.20	0.20	0.20
Total	100.0	100.0	100.0	100.0	100.0
Calculated Values					
Crude protein (%)	16.10	16.20	16.29	16.36	1647
Energy (Kcal/g)	2.62	2.61	2.60	2.60	2.61

*Premix to supply the following per kg of diet: 1500, iu Vit A; 1500, iu Vit.D; 3000iu, Vit E; 3.0g Vit K; 2.5g Vit.B_2; 0.3g Vit. B_6; 8.0mg B_{12}; Nicotinic acid 3.0g; Ca- Pantothenate 5.0mg; Fe 10.0mg; Al, 0.2mg; Cu 3.5mg; Zn 0.15mg ; I, 0.02g; Co, 0.01g; Se 0.02g

Experimental pullets and their management: A total of 150 pullets at 16 weeks of age were used for this experiment. They were divided into 5 treatment groups in 3 replicates such that each group had 30 pullets with 10 pullets per replicate. Data collection was done for 18 weeks starting from 17th week to 35 weeks of age.

Data collection: Data were collected on mean weekly feed intake, body weight, weight gain, feed conversion efficiency, egg production %, external and internal quality characteristics of eggs.

Egg collection: The total number of eggs laid per replicate group were collected on daily basis and recorded. The eggs were collected twice daily in the morning (9.00a.m) and evening (5.00 pm). Three fresh eggs (large, medium and small) were separated weekly for analysis.

Egg weight: Egg collected from each replicate were labeled and weighed to the nearest 0.01g using a sensitive top loading electric weighing balance.

Egg circumference: This was measured using vernier sliding calipers as described by Ayanwale and Gado (2001). The results obtained from the measurements of egg circumference and egg length were used to compute the egg shape index.

Egg length: The length of each egg was measured from the pointed end to the blunt end with the aid of vernier sliding calipers.

Egg shape index: Egg shape index was computed as the ratio of egg width to the length (Awosanya *et al.* 1998).

Egg shell thickness: Each egg used for the internal egg quality measurement was broken on a small petrish-dish. Egg membranes were carefully removed from the shells. Shell thickness was measured with a micrometer screw gauge. The measurements were taken from the top (pointed part), bottom (round part) and the middle of the egg, the average was then computed.
Egg shell weight: Egg shell weight was taken using sensitive top loading electric weighing balance. After the membranes were carefully removed, egg shells were wiped with clean dried filter paper.

Internal egg quality: Albumen weight and height: The albumen of the broken fresh eggs were carefully separated from the yolk using yolk cups. Tripod micrometer was then used to measure the albumen height. Albumen weight was measured with the sensitive weighing balance.

Yolk weight and height: After the separation of the yolk and the albumen, the albumen that may be attached to the yolk was blotted by rolling the yolk on a damp filter paper and weighed. The diameter was then measured as maximum cross sectional diameter using a spherometer. The yolk height was measured as using the tripod micrometer.

Hen-day production: The total number of eggs produced per replicate per week were taken. From the records of egg production and the number of pullets alive, the hen – day production percentage (HDPP) was calculated as:

$$HDPP = \frac{\text{Total numberof eggs laid per group}}{\text{Total number of pullets survived}} \times 100$$

Table 2: Proximate composition of the experimental dried yeast (%)

Components:	Dry matter	Ether extract	Crude protein	Crude fibre	Ash	Nitrogen free extract
	96.39	4.85	59.09	11.65	7.98	12.82

Table 3: Performance characteristics of pullets fed *Saccharomyces cerevisiae* contained yeast

	Yeast levels in (%)				
	0.0	0.25	0.50	0.75	1.0
Mean weekly feed intake Kg/bird	0.64	0.65	0.65	0.63	0.65±0.12
Mean weekly weight gain g/bird	42.27	46.81	55.91	44.45	42.27±2.55
Mean weekly egg Production/bird	6.45	6.46	6.45	6.48	6.46±1.22
Mean cracked egg%	5.91	5.86	5.68	4.32	4.83±3.02
Hen-day production%	75.00	78.75	75.71	82.25	78.15±4.62

a, b, means denoted by the same alphabets in the same row are not significantly. (P > 0.05) different.

Data analysis: Data collected from the various measurements were subjected to analysis of variance (ANOVA) using randomized complete block (RCB) design as described by Gomez and Gomez (1984). Differences between the means were separated using Duncan Multiple range test where there were significant (Duncan, 1955) (P< 0.05).

Results and Discussion

The results of the proximate analysis of the dried yeast (DY) indicated in Table 2 shows that SDY has the following composition, dry matter(DM) (96.39 %),crude protein (CP) (59.09 %), crude fibre (CF) (11.65 %), ether extract (EE) (4.85 %) and 7.98 % ash. These values were in agreement with the values of 96.84 % DM, 45-55 % CP, and 5-7 % ash reported in Encyclopedia of Food Science, Technology and Nutrition (1997) except the ether extract value of 0.5- 2.5 % that is a little higher in this study.

Table 3 shows no significant (P>0.05) differences in the performance parameters measured which were mean weekly feed intake, body weight gain, mean cracked eggs, hen- day production percentage, feed conversion efficiency and mean weekly egg production per bird. Pullets fed 0.75 % SDY containing *S. cerevisiae* produced the best FCE or feed intake per dozen of egg laid as described by Oluyemi and Roberts (1979).

Table 5 gives the gross profit that can accrue to a farmer who endeavours to supplement pullet feeds with SDY. The Table shows that supplementation at 0.50 % and below brings less profit than the control while supplementation above 0.75 % reduced the gross profit compared to the control.

Table 4 shows that supplementation of the diets with 0.75 % SDY significantly (P<0.05) improved egg weight and shell weight. Similarly, 0.75 % SDY inclusion significantly improve
d (P<0.05) yolk weight, height and Haugh unit.

Discussion

The proximate composition of SDY shows it to be a protein supplement due to its content of 59.09 % CP. The fibre content of SDY (11.65 %) appears to be on the high side for poultry birds but McDonald *et al.* (1995) stated that yeast fibre, though high, does not compose of cellulose, hemicellulose and lignin as in the foods of plant origin rather the fibre consists chiefly of glucans, mannans and chitin. This contributes remarkably to the high digestibility coefficient of yeast (0.70-0.90) in pigs and poultry. A condition which makes SDY to be suitable for poultry feeding. The high ash level of SDY has been attributed to its level of phosphorus (P) (Thayer and Jackson, 1975; Thayer *et al.,* 1978; Bradley and Savage, 1985). This situation can lead to better bone mineralization in the animals

The performance characteristics results of the SDY fed pullets compare well with the control and other results shown on pullet performance (Oluyemi and Roberts, 1979; Ayanwale and Gado, 2001). The mean egg weight of the pullets is however lower than the egg weights (60.0 g) reported for pullets in the tropical environment (Oluyemi and Roberts, 1979). This disparity could be due to the differences in the age of the birds. Supplementation of the feeds with 0.75 % *S. cervisiae* containing SDY improved egg weight due to improvement in FCE (Table 3). This finding is in agreement with Day, (1997), Savage *et al.* (1985), Onifade and Babatunde (1996) who reported that yeast culture enhanced feed efficiency in turkey and broilers respectively. Thayer and Jackson (1975) and Thayer *et al.* (1978) found that yeast culture increased organic phosphorus utilization in turkey. The increased mineralization of eggs by the SDY might be responsible for the high shell weight observed in SDY – fed pullets. The improvement observed in internal egg quality (Yolk weight and Haugh unit) could be due to the supply of yeast phytase coupled with the supply of some essential micro- nutrients as reported by Thayer *et al.* (1978) that yeast phytase is capable of increasing bio-availability of certain minerals such as Ca, Cu, Zn, Fe, Mn and even gross energy of the feed in agreement with Scott *et al.* (1982) and Erdman (1989).

Table 5 shows that the major index of pullet business which is profit making favours SDY supplementation at

Table 4: Egg quality characteristics of pullets fed *Saccharomyces cerevisiae* contained yeast

	Dried yeast levels				
Parameters	0.0	0.25	0.50	0.75	1.00
External egg quality					
Egg weight (g)	51.83[a]	52.03[a]	50.98[a]	56.02[b]	51.74a±4.66
Length (mm)	53.90	54.60	54.04	54.58	54.78±2.40
Circumference(mm)	4.24	4.19	4.11	4.20	4.23±0.23
Shell thickness(mm)	0.48	0.46	0.49	0.46	0.48±0.10
Shell weight (g)	4.26[a]	4.56[ab]	4.39[ab]	4.71[b]	4.43ab±0.48
Egg shape index	0.78	0.76	0.77	0.77	0.78±0.09
Internal egg quality					
Yolk weight (g)	12.62[a]	11.91[a]	12.15[a]	13.21[b]	12.42ab±1.08
Yolk height (cm)	1.63[b]	1.60[ab]	1.52[ab]	1.59[b]	1.48a±0.14
Albumen weight (g)	33.22	33.22	33.61	33.66	33.68±1.07
Albumen height (cm)	5.38	5.99	5.73	5.44	5.37±0.84

A, b: means denoted by different alphabets in the same row are significantly (P< 0.05) different.

Table 5: Gross benefit from supplementing Saccharomyces cerevisiae contained dried yeast in the diet.

Dried yeast levels	0.0	0.25	0.50	0.75	1.00(%)
Mean weekly feed intake(g) /bird	0.64	0.65	0.65	0.64	0.65
Cost per kg of feed(N)	38.75	38.80	38.86	38.88	38.89
Number of birds	30.00	30.00	30.00	30.00	30.00
Number of weeks fed	18.00	18.00	18.00	18.00	18.00
Total feeding cost (N)	13,392.00	13,618.80	13639.86	13226.98	13,650.39.00
Total egg produced	3,481.20	3,488.40	3,483.00	3,499.20	3,488.40
The price of egg sold	52,218.00	52,326.00	52245.00	52,488.00	52,326.00
Price per egg (N)	15.00	15.00	15.00	15.00	15.00
Labour (N)	8400	8400	8400	8400	8400
Cost of drugs (N)	21750.00	21750.0	21750.00	21750.00	21750.00
Total cost of production(N)	43542	43768.80	43789.86	43376.98	43800.39
Gross benefit (N)	8, 676.00	8,557.20	8,455.14	9,111.02	8525.61

0.75 % level. The nine thousand and one hundred and eleven naira, two kobo (N 9,111.02) from group T4 is superior to the value of eight thousand and six hundred and seventy six naira (N8,676.00) from the control. SDY supplementation at a level above 0.75 % did not bring additional profit.

Conclusion: SDY contains high dry matter (96. 39 %), crude protein (59.09 %), and crude fibre (11.65 %). Feeding 0.75 % SDY diets to pullets improved FCE, egg weight, internal egg quality characteristics and gross benefit from the pullets.

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