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INFLUENCE OF *Saccharomyces cerevisiae* SUPPLEMENTATION ON WATER CONSUMPTION, LENGTH OF INTESTINAL TRACT AND HEN-DAY EGG PERFORMANCE OF LAYERS

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ABSTRACT

This study investigated the influence of the probiotic, Saccharomyces cerevisiae, on water consumption, length of the intestinal tract and hen-day egg production of Dominion breed of layers. A total of 100 layers were randomly divided into four groups (A - D) of 25 birds per group. The 25 layers in each group were further sub-divided into 5 replicates of 5 layers each. The diet for layers in groups A, B and C was supplemented with the probiotic at varied levels of 0.6, 0.8 and 1.0 g/kg of feed, respectively. Layers in group D (control) were fed diet that had no probiotic. They were maintained on 125 g of feed/bird/day. The volume of water consumed by each group was measured daily. The lengths of different sections of the intestine were measured. Number of eggs laid by each group was recorded daily. Layers in group C had significantly (p <0.05) higher water consumption than others. The length of the colon was significantly (p <0.05) higher in layers in group C (11.97 ± 1.41 cm) compared to groups A (7.27 ± 0.52), B (10.30 ± 1.56) and D (7.70 ± 0.42). on the other hand, the duodenum was longest in group B (47.17 ± 17.68) followed by groups C (31.70 ± 2.83), A (25.90 ± 2.33) and D (19.47 ± 6.09) respectively. The mean hen-day egg performance was also significantly (p<0.05) higher in layers in group C (85.00 ± 10.12) compared to those in groups A (68.00 ± 9.35), B (70.00 ± 7.15) and D (65.00 ± 5.06). In conclusion, the probiotic supplementation at 1.0 g/kg of diet, significantly increased water consumption and hen-day egg performance. Probiotic inclusion level of 1.0 g/kg of diet was recommended for optimum hen-day egg production.

Keywords: Layers, Feed, Probiotic, Water intake, Length of intestine. Egg production.

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INTRODUCTION

Most African diets are deficient in animal protein which results in poor and stunted growth as well as low resistance to diseases and consequent human health problems [1]. There is need to develop the poultry

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industry which has been described as the fastest means of bridging the animal protein deficiency gap prevailing in most developing countries [2].

Feed supply is one of the major constraints to poultry production in the tropics. The cost of feed alone accounts for 70 – 80% of the total cost of production [3]. High cost of feed compels poultry farmers to compound poor quality and highly fibrous diets. The problem with high fibre diet is that it decreases digestibility leading to poor efficiency of feed utilization. Fuller [4] reported that there are biotechnological options for enhancing the nutritive value of high fibre diets. The biotechnological treatment to improve the digestibility of fibrous diet includes either direct use of microorganisms or microbial enzymes [5].

Studies have shown that inclusion of live yeast (probiotic) in animal feed increases the nutritive quality and efficiency of feed utilization [6,7]. The objective of this study was to investigate the effect of the probiotic, *Saccharomyces cerevisiae*, supplementation on water consumption, length of the intestinal tract and hen–day egg performance of laying birds.

MATERIALS AND METHODS

This study was carried out at the Department of Animal Health and Production Experimental Poultry Unit, University of Nigeria, Nsukka. Nigeria.

Experimental Diets

The compositions of the experimental diets are shown in Table 1.

Experimental Animals/Design

A total of 100 layers (Dominion breed) were randomly selected and divided into four groups (A-D) of 25 birds each. Each group was subdivided into 5 replicates of 5 birds each. Groups A, B and C had their diet supplemented with varied levels of probiotics at 0.6, 0.8 and 1.0 g per kg of feed respectively, while group D the control ration had no probiotic (Table 1). The birds were on the experimental diet for twelve months of egg production. All the groups were fed same quantity of feed (125 gm / bird / day) in two divided doses at 08.00 and 16.00 hours respectively. They were given water *ad libitum*. Eggs were collected three times a day at 09.00, 12.00 and 15.00 hours respectively.

Data Collection

The quantity of feed and water consumed by each group was recorded daily for the period of the study. The number of eggs produced by each group was also recorded daily. The experiment lasted ten weeks.

At the tenth week, five layers were randomly selected from each group, humanely sacrificed, eviscerated and the length of different sections of the intestinal tract (i.e. duodenum, ileum, jejunum, caeca and colon) were measured using a metre rule.

Data Analysis

The data generated in the study were subjected to a one-way analysis of variance and the variant means were separated using the least significant different method. The significant differences were accepted at $p < 0.05$ and the final results were presented as mean ± standard error.

RESULTS

The composition of the experimental layers' mash is shown in Table 1. There were significant differences ($p < 0.05$) in the volume of water consumed by layers in groups A, B and C whose diets were supplemented with the probiotic (Table 2). Layers in group C (supplemented with 1.0 g / kg) consumed significantly ($p < 0.05$) more water at weeks 1, 4, 5, 6, 8 and 9 than layers in groups A, B and D (Table 2).

Table 1. Gross composition of the ingredients used to compound the experimental layers' mash supplemented with varied levels of *Saccharomyces cerevisiae*.

Ingredients	Group A (0.6 g/kg)	Group B (0.8 g/kg)	Group C (1.0 g/kg)	Group D (0.0 g/kg)
Maize	35.00	35.00	35.00	35.00
PKC	25.00	25.00	25.00	25.00
Soybean meal	12.00	12.00	12.00	12.00
Fish meal	5.00	5.00	5.00	5.00
Wheat offal	15.44	15.42	15.40	15.50
Bone meal	5.00	5.00	5.00	5.00
Limestone	1.00	1.00	1.00	1.00
Probiotic	0.06	0.08	0.10	0.00
Salt	0.50	0.50	0.50	0.50
Lysine	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20
Premix	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**

Layers in group C had significantly ($p < 0.05$) longer colon (11.97 ± 1.41 cm) followed by layers in group B (10.30 ± 1.56 cm) while the length of the colon of layers in group D (control) was the least (7.70 ± 0.42 cm) (Table 3). The length of duodenum was significantly (p < 0.05) longer in group B (47.17 ± 17.68 cm), followed by group C (31.70 ± 2,83 cm) and shortest in the control (19.47 ± 6.09 cm).

The study also showed that layers in group C had significantly (p < 0.05) higher hen-day egg production (85.00 + 10.00%) compared to groups A (56.23±2.08%), B (48.29 ± 5. 33%) and D (49.92 ± 0.83%).

DISCUSSION

This study revealed significant increase in productive performance among group C birds fed diet supplemented with 1.0 gm of the probiotic. They also consumed the highest quantity of water and recorded the highest number of hen-day egg performance during the study. These findings could be attributed to the effect of the probiotics on nutrient utilization [8] which probably increased water consumption by the layers. The findings of this study suggest that probiotic supplementation increased efficiency of feed utilization and consequently improved productive performance of laying birds. An earlier report [9] also showed that probiotics increased productive performance in animals. The study also revealed that group B had significantly longer duodenum compared to other groups. Duodenum is the centre for nutrient digestion and absorption in birds and this may have contributed to the improved hen-day egg performance observed in group B compared to groups A and D.

The mode of action of probiotic in stimulating increased productive performance may possibly be as a result of increase in nutrient availability and volatile fatty acid production which are directly absorbed in the hindgut and used as energy source in the tissues [10]. Probiotics also stimulate growth by regulating the immune system which leads to suppression of the negative effects of chronic immune activation [11,12]. Probiotics have also been found to protect epithelial barriers, nutrient absorption and productive performance.

On the other hand, another study [13] did not find any significant difference in the performance of chicken fed diets containing a mixture of *Lactobacillus* cultures and other bacteria, compared with a non-supplemented diet. It was observed that the variations in the effects of probiotics on growth performance of broiler chicken may be attributed to the differences in the strains of bacteria used as the dietary supplements.

Probiotic supplementation with *Saccharomyces cerevisiae* led to an increase in length of the colon in group C laying birds; this may possibly have provided a wider surface area for absorption of water which is the primary function of the colon in birds as well as increased availability and absorption of volatile fatty acids as observed by Ajuwon [10]. The group C laying birds that had the longest colon, consumed the highest quantity of water and laid the highest number of eggs. Lacy [14] reported that birds that consumed more water tended to have higher efficiency of feed utilization. In conclusion, inclusion of the probiotic, *S. cereviasae*, at 1.0 g/kg level in the diet of layers significantly increased water consumption, efficiency of feed utilization and hen-day egg performance.

Table 2: The mean water consumption of the layers fed diets supplemented with varied levels of the probiotic, *Saccharomyces cerevisiae*.

Expt. Period (Weeks)	Group A (0.6 g/kg)	Group B (0.8 g/kg)	Group C (1.0 g/kg)	Group D (Control)
1.	303.91 ± 4.17^{a}	324.80 ± 7.02^{b}	331.91 ± 5.41^{b}	327.36 ± 6.16^{b}
2.	317.91 ± 7.73	332.60 ± 6.26	331.11 ± 5.56	327.31 ± 6.21
3.	303.35 ± 1.98^{a}	330.50 ± 7.68^{b}	325.10 ± 4.19^{b}	318.81 ± 7.38^{ab}
4.	289.99 ± 7.10^{a}	302.32 ± 3.97^{a}	342.09 ± 6.53^{b}	299.27 ± 3.42^{a}
5.	350.58 ± 4.80^{a}	350.59 ± 9.46^{a}	380.70 ± 9.40^{b}	348.94 ± 4.51^{a}
6.	320.90 ± 6.01^{a}	332.47 ± 4.21^{a}	364.70 ± 10.23^{b}	358.23 ± 8.54^{b}
7.	332.94 ± 4.02^{a}	354.35 ± 5.49^{b}	353.76 ± 8.28^{ab}	361.99 ± 9.36^{b}
8.	309.06 ± 21.56	319.53 ± 15.14	331.29 ± 22.36	328.00 ± 17.96
9.	338.11 ± 5.44^{a}	328.35 ± 4.03^{a}	358.59 ± 6.67^{b}	342.11 ± 8.62^{ab}
10.	332.94 ± 10.82	320.82 ± 6.21	300.82 ± 15.11	318.04 ± 13.51

[a,ab,b]Figures in a row with different superscripts are significantly different ($p < 0.05$)

Table 3: Lengths (cm) of different sections of intestine and hen-day egg production (%) of layers fed palm kernel cake-based diet supplemented with varied levels of the probiotic, *Saccharomyces cerevisiae*

Section of GIT	Group A (0.6 g/kg)	Group B (0.8 g/kg)	Group C (1.0 g/kg)	Group D (control)
Duodenum	25.90 ± 2.33a	47.17 ± 17.68 c	31.70 ± 2.83 b	19.47 ± 6.09 ab
Ileum	101.37 ± 9.33	115.95 ± 2.34	106.10 ± 3.81	113.30 ± 1.01
Jejunum	14.87 ± 0.94	22.77 ± 1.13	21.40 ± 4.16	15.07 ± 1.41
Caeca	17.20 ± 1.15	21.57 ± 2.57	19.15 ± 1.24	18.70 ± 0.40
Colon	7.27 ± 0.52 a	10.30 ± 1.56 ab	11.70 ± 1.56 b	7.70 ± 0.42 a

[a,ab,b]Figures in a row with different superscripts are significantly different ($p < 0.05$).

Table 4: The monthly hen-day egg performance (%) of layers fed palm kernel cake-based diet supplemented with graded levels of Probiotic, *Saccharomyces cerevisiae*.

Months of the year	Group A (0.6 g/kg probiotic)	Group B (0.8 g/kg probiotic)	Group C (1.0 g/kg probiotic)	Group D (Control No probiotic)
November	16.06 ± 1.16[ab]	20.20 ± 1.17[b]	36.00 ± 2.89[c]	10.12 ±1.74[a]
December	44.96 ± 1.51[a]	58.00 ± 1.73[b]	73.31 ± 4.63[c]	40.30 ± 1.19[a]
January	68.09 ± 1.73[a]	70.05 ± 2.89[a]	87.05 ± 4.04[b]	66.13 ±1.74[a]
February	85.30 ± 2.90[ab]	88.94 ± 2.31[bc]	96.11±1.16[c]	80.32 ± 2.33[a]
March	92.04 ± 1.16[a]	94.17 ± 1.17[a]	95.31 ± 1.87[a]	89.17 ± 2.89[a]
April	90.28 ± 1.75[a]	83.20 ± 1.74[b]	96.157 ± 1.74[c]	89.44 ± 1.44[a]
May	80.12 ± 2.89[a]	82.27 ± 1.19[a]	96.17± 0.60[b]	80.13 ± 1.74[a]
June	77.09 ± 1.15[a]	80.06 ± 0.58[a]	95.20 ± 1.74[b]	76.07 ± 2.31[a]
July	75.03 ± 1.14[a]	80.01 ± .58[b]	94.27 ± 2.33[c]	74.04 ±1.16[a]
August	68.14 ± 1.74[a]	70.20 ± 2.89[a]	90.04 ± 2.89[b]	67.35 ± 2.34[a]
September	63.17 ± 1.17[a]	60.24 ± 1.75[a]	90.20 ±1.17[b]	55.27 ± 1.75[c]
October	60.08 ± 2.31[a]	57.17 ± 1.17[ac]	73.08 ±1.73[b]	52.15 ± 1.16[c]
Mean	68.00 ± 9.35	70.00 ± 7.15	85.00 ± 10.12	65.00 ± 5.06

[a,ab,b]Figures in a row with different superscripts are significantly different ($p < 0.05$).

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