EFFECTS OF GRADED LEVELS OF ALPHAMUNE G ON PERFORMANCE OF GROWING PULLETS TO LAYING HENS

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ABSTRACT

The study was conducted to investigate the effects of Alphamune G fed to growing pullets on their performance during laying. A total of one hundred and forty four (144) commercial black Harco pullet chickens made up of seventy-two (72) each of age 19 weeks old (group A) as well as age 15 weeks old (group B) were fed four graded levels of Alphamune G (0.00, 0.04, 0.05 and 0.06 % inclusion level). A factorial arrangement of four levels of dietary Alphamune G and two age groups were the treatments in a Complete Randomized Design. The study was conducted for 17 weeks, when the birds of each of group A and B attained age 36 weeks and 32 weeks, respectively. Laying pullets fed the control diet 0.00% had the highest value of egg weight, shell thickness and feed intake. Highest values for feed to gain ratio, feed per dozen eggs and feed cost per dozen eggs were observed in laying pullets fed 0.04% inclusion level of Alphamune G. The haugh unit, yolk index and weight gain were observed to have the highest value in layers fed 0.05%. Highest values was observed for % hen day production for laying hens fed 0.06% inclusion level of Alphamune G. In conclusion, among laying hens fed dietary levels of Alphamune G, birds fed inclusion levels of 0.06% performed the best in terms of production characteristics, egg quality and economic value compared to 0.04% and 0.05%.

Keywords: Alphamune G, Growing pullets, Laying hen, Production characteristics, Egg quality, Economic value

INTRODUCTION

The egg industry is enjoying increased production as consumers have become more educated about the nutritive value of eggs. Eggs are relatively inexpensive per unit of protein and energy, therefore egg consumption has continued to increase in developing countries (Leeson and Summers, 2005). For several decades, antibiotics and chemotherapeutics in prophylactic doses have been used in animal feed to improve animal welfare and to obtain economic benefits in terms of improved animal performance and reduced medication costs. Disease control accounts for over 10% of the total cost of Isa-brown production (Kabir and Haque, 2010).

There are increasing concerns about the risk of developing cross-resistance and multiple antibiotic resistances in pathogenic bacteria in both humans and livestock linked to the therapeutic and sub therapeutic use of antibiotics in livestock and pets (Bolu *et al.,* 2009a). The European Union has banned all in-feed use of antibiotics from 2006 and the use of antibiotics in feed is being considered for elimination in other parts of the world. This perspective has stimulated nutritionists and feed manufacturers to search for new and safe alternatives (Hajati and Rezeal, 2010). Several products with different modes of actions have been proposed, including prebiotics, probiotics, acidifiers and phenolic compounds.

Alphamune G is an alternative to antibiotics growth promoter (Alpharma Animal Health, 2004). It is one of the products that have a beneficial impact on the overall health of the gut of different species of poultry birds. Alphamune G is a spray dried and granulated product produced after the autolysis of food grade yeast (*Saccharomyces cerevisae*). It contains a unique combination of (1-3, 1-6) β-glucans and mannan oligosaccharides. The β-glucans have been shown to be involved in enhancement of the immune system (Huff *et al.,* 2006). Mannan oligosaccharides on the other hand have prebiotic effect when fed to biological systems (Jözefiak *et al.,* 2004). Yeast has been used in fermentation technology for production of alcohol and in food industry. *Saccharomyces cerevisae* one of the most widely commercialized types of yeast, has long been fed to animals. Addition of live yeast to animal feed has been known to improve the nutritive quality of feed and performance of animals (Martin *et al.,* 1994). In addition, mannan oligosaccharide derived from the cell wall of the yeast *S. cerevisae* has shown promise in suppressing enteric pathogens and modulating the immune in studies with poultry (Iji and Tivey, 1999; Santin *et al.,* 2001). Additionally, there are trials showing that enrichment of diets with yeast could favorably improve the feed efficiency and growth rate (Ghasemi *et al.,* 2006) and carcass percentage (Vargas *et al.,* 2002). The additional cost of Alphamune G to the ration yield a superior financial performance in previous study using 500g per ton of ration (Alpharma Animal Health, 2004). Bolu *et al.* (2009 a,b) reported 0.04% and 0.06% dietary inclusion of Alphamune G gave better performance in broiler and cockerel chicks, respectively. The use of Alphamune G in growing to laying pullets is expected to reduce cost incurred on medication, improve feed and production efficiency thereby giving the farmers more turn-over. This study was conducted to investigate the effects of feeding graded levels of Alphamune G on laying performance as well as the optimum time and level at which Alphamune G can be administered to diet for optimum production from growing pullets to laying hens.

MATERIAL AND METHODS

A total of 144 commercial black Harco pullet chickens made up of seventy-two (72) each of age 19 weeks old (group A) and 15 weeks old (group B) were used for study. The study lasted for a period of 17 weeks when the birds in each of the groups (A and B) attained 36 and 32 weeks old, respectively. The birds were housed in battery cages. Routine management and vaccination programme necessary for pullets and layers production were followed. Feed and water were given *ad-libitum* to the birds throughout the experiment.

Treatments consist of four graded levels of dietary Alphamune G (0.00, 0.04, 0.05 and 0.06 %) incorporated into the diets (Table 1). The pullets in each group were weighed and randomly allocated to each of the four levels of Alphamune G in 6 replicates of 3 birds. Pre-lay diet was fed to birds for twenty-one days of the experiment after which the layer diet was fed till the end of the experiment.

Production Parameters Recorded

Weight gain: The initial weights of the birds in grams were recorded at the onset of the experiment using a weighing scale balance and subsequent weights of the birds were recorded on weekly basis. The difference in weight for each week was used to determine the weight gain record.

Feed intake: The feed intake recorded in grams was calculated from the difference between the weight of the feed offered and the weight of the left over for each respective replicate on weekly basis.

Feed to gain ratio: The feed to gain ratio for each respective replicate was determined by the ratio of feed intake to weight gain on weekly basis.

Age at first egg lay and hen day production (HDP): Age of first egg lay for each treatment was recorded and hen day production was recorded for each replicate; % HDP = Number of eggs produced × 100 / Number of hen-days; where hen-day = Number of hens × number of days in lay.

Feed utilization efficiency: This was obtained as the total feed consumed to the produce a dozen eggs.

Mortality: This was computed as the ratio of dead to stock birds in percentage thus; % Mortality = Total number of dead bird × 100 / Total number of birds stocked.

Egg Assessment

Average egg external and internal qualities i.e. shell thickness, egg weight, yolk and albumen width as well as yolk and albumen height were determined at age 28 to 32 weeks old for each group of birds at an interval of two weeks.

Egg weight: Eggs were weighed on the weighing scale balance and recorded. This was used in calculating the Haugh unit.

Albumen height: Blunt steel was used to crack the shell to avoid rupturing of the albumen in breaking the egg. A tripod spherometer marked 0.1mm was used to take the height of the albumen at the mid-point.

Albumen width: The albumen width was measured with the venier caliper.

Haugh unit: The albumen height and egg weight records were used to compute the haugh unit. The haugh unit is calculated from the formula: $H.U = 100 \log (H - G) \sqrt[2]{} (30W^{0.37} - 100) + 1.9/100$, where HU= Haugh unit, H= Albumen height (mm), G = 32.2, W = Weight of the egg (g).

Yolk index: This was obtained from the formula: Yolk Index = Yolk height / Yolk diameter (width). Yolk height was measured with the spherometer while the yolk diameter was measured with the venier caliper.

Shell thickness: This was measured with the aid of the micrometer screw gauge. The egg shell thickness was measured at three points namely, the broad region, the equatorial region and narrow region. The average was used.

Nutrient retention: Twelve (12) pullets of average body weights from each groups (A and B) at 32 weeks old were selected respectively and placed in a separate battery cage compartments to serve as metabolic cage. Each selected birds was fed the dietary treatments for a period of three (3) days after which the weight of feed offer, left over and feacal output were recorded. Feed intake record was deduced from the difference between the weights of feed offer and left over. Proximate analysis (i.e. crude protein, crude fat, crude fiber and ash) of the experimental diets and feacal sample was carried out according to the Association of Official Analytical Chemist (AOAC, 1990).

Statistical Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) using Genstat 5, Release 3.2 (2nd Edition) statistical software. Means were separated by Duncan New Multiple Range Test (Duncan, 1955).

RESULTS

Average feed to gain ratio, % production, weight gain, egg weight, feed per dozen egg, feed cost per dozen egg and the haugh unit were not influenced by dietary inclusion levels of Alphamune G ($p>0.05$) . However, feed intake, yolk height, egg shell thickness and yolk index were significantly affected by the treatments ($p<0.05$) (Table 2). Between groups, % hen day production and feed cost per dozen egg were significantly different ($p<0.05$) (Table 3). There were significant differences ($p<0.05$) in the interaction effects of Alphamune G and age groups on egg thickness, haugh unit, feed to gain ratio and feed intake (Table 4).

Laying hens in group A fed the control diet had the highest value for average weight gain, average egg weight and average shell thickness.

Table 1: Ingredients and nutrient composition experimental diets fed to growing pullets to laying hen administered graded levels of Alphamune G

Ingredients	Prelay Diet	Layer Diet
Maize	46.42	58.00
Corn Bran	12.50	5.00
Wheat Bran	11.00	7.00
Palm Kernel Cake	6.00	0
Fish Meal 68%	1.50	2.00
Soyabean Meal	15.00	18.00
Oyster Shell	4.65	2.00
Bone Meal	2.20	7.30
Vitamin Premix	0.25	0.25
Lysine	0.1	0.1
Methionine	0.1	0.1
Salt	0.27	0.25
Total	100	100
Calculated Nutrient Composition (%)		
Metabolizable Energy(Mekcal/Kg)	2661	2761
Crude Protein	16.1	16.1
Lysine	0.72	0.78
Methionine	0.27	0.29
Calcium	2.5	3.46
Phosphorus	0.83	0.77

Birds in group B fed 0.04% Alphamune G had the highest values for average feed intake and average feed cost per dozen eggs, while average percentage hen day production was the least at this level. Laying hens in group A fed 0.05% Alphamune G had the least value in average weight gain and average feed to gain ratio, while those of 15 weeks at the onset of the experiment fed similar dietary level of Alphamune G had the highest value in average feed to gain ratio, average feed per dozen eggs and yolk index. Yolk index value was lowest in birds of 19 weeks old fed 0.04% Alphamune G, while the least value for average feed intake value was observed in laying pullets of 15 weeks old at the onset of the experiment fed 0.05% Alphamune G. Birds of 19 weeks old at the inception of the experiment fed 0.06% Alphamune G had the highest value in % hen day production as well as the least values for average feed per dozen egg and average feed cost per dozen egg. The lowest value for average egg weight was observed in birds of 15 weeks old at the onset of the experiment fed 0.06% Alphamune G and birds of 19 weeks old fed 0.05% Alphamune G for average shell thickness. Haugh unit value was highest in birds of 15 weeks old fed 0.04% Alphamune G and the least value for similar birds fed 0.06% Alphamune G (Table 4).

There were significant differences ($p<0.05$) for all nutrient retention parameters analyzed in the experiment. The control diet had the highest value in % crude protein retention, % crude fat retention, % crude fibre retention and % ash retention. Lowest value of % crude protein retention was observed in 0.06% Alphamune G while 0.04% Alphamune G had the least values in % crude fat retention, %crude fibre retention and % ash retention (Table 2). For all the nutrient parameters analyzed, growing to laying pullets of age 15 weeks old at the onset of the experiment had higher value than those of age 19 weeks old at the onset of the experiment (Table 3). It was also observed that birds of age 15 weeks old at the onset of the experiment fed the control diet had the highest values in all % nutrient retention parameters for the interaction of Alphamune G and age at which Alphamune G was fed while birds of age 19 weeks old fed 0.04% Alphamune G diet had the least values for % crude fibre retention, % crude fat retention and % ash retention. Laying pullets of age 19 weeks old fed 0.05% Alphamune G had the least value for % crude protein retention. Percentage crude protein retention had the highest value in laying pullets of age 15 weeks old at the onset of the experiment fed the control diet while the least value was recorded in birds of age 19 weeks old fed 0.05% Alphamune G diet (Table 4).

DISCUSSION

Results on weight gain were different from the report of Bolu *et al.* (2009 a,b). However, the recommended 0.04% dietary inclusion of Alphamune G also gave the highest weight gain

Table 2: Effects of Alphamune G and age on production characteristics, egg quality traits and nutrient retention of growing pullets to laying hen

Parameters	Age Difference	
	A	B
Average Feed Intake(g/bird/day)	86.83 ± 0.73	85.59 ± 0.86
Average Weight Gain (g/bird/day)	4.63 ± 0.74	4.39 ± 0.62
Feed To Gain Ratio	13.10 ± 3.02	16.30 ± 2.86
%HDP	47.00 ± 2.46^{b}	37.80 ± 2.11^{a}
Feed(g)/Dozen Egg	2.34 ± 0.56	2.51 ± 0.95
Feed Cost(₦)/Dozen Egg	159.00 ± 2.46^{a}	215.00 ± 4.82^{b}
Egg Weight(g)	56.91 ± 0.42	55.92 ± 0.70
Shell Thickness (mm)	0.31 ± 0.02	0.32 ± 0.01
Yolk Index	0.42 ± 0.04	0.45 ± 0.03
Haugh Unit	78.70 ± 1.87	79.30 ± 1.42
Protein Retention (%)	48.25 ± 3.28^{a}	56.72 ± 2.56^{b}
Fat Retention (%)	44.58 ± 4.64^{a}	54.35 ± 2.86^{b}
Fibre Retention (%)	-3.40 ± 2.20^{a}	20.30 ± 3.48^{b}
Ash Retention (%)	-45.13 ± 1.42^{a}	-18.65 ± 2.26^{b}

a,b-means followed by the same superscript letter in the same row; are not significantly different (P>0.05).

Table 3: Effects of graded levels of Alphamune G on production characteristics, egg quality traits and % nutrient retention of growing pullets to laying hen

Parameters	Alphamune G Levels			
	0.00%	0.04%	0.05%	0.06%
Feed Intake(g/bird/day)	86.53 ± 1.03^{a}	88.80 ± 10.10^{b}	83.87±2.54^{a}	85.64±1.26^{a}
Weight Gain (g/bird/day)	5.30 ± 2.46	5.47 ± 1.88	3.60±2.16	3.67±2.12
Feed to Gain Ratio	11.8 ± 4.26	16.9 ± 2.24	13.8±3.24	16.4±2.18
Hen Day Production (%)	42.7 ± 2.36	40.2 ± 3.56	39.8±5.48	47.0±4.38
Feed(kg) Per Dozen Eggs	2.65 ± 1.22	2.84 ±1.35	2.77±1.26	2.43±1.34
Average Feed Cost(₦)/Dozen Egg	180.00 ± 20.34	215.00 ± 23.12	188±22.56	165±23.15
Egg Weight(g)	57.39 ± 0.93	56.22 ± 0.56	56.77±0.64	55.29±0.72
Shell Thickness(mm)	0.34 ± 0.01^{b}	0.31± 0.01^{a}	0.31±0.02^{a}	0.31±0.01^{a}
Yolk Index	0.43 ± 0.05	0.43 ± 0.04	0.48±0.05	0.41±0.04
Haugh Unit	78.3 ± 4.58	80.20 ± 2.56	81.9±2.65	75.6±3.86
Protein Retention (%)	68.30 ± 4.52^{b}	47.55 ± 2.55^{b}	48.60±2.48^{b}	45.50±2.24^{a}
Fat Retention (%)	63.80 ± 3.86^{c}	39.45 ± 4.56^{a}	41.70±3.36^{a}	52.90±5.44^{b}
Fibre Retention (%)	35.20 ± 3.38^{d}	-8.40 ± 2.12^{a}	0.0±0.02^{b}	6.8±2.56^{c}
Ash Retention	9.65 ± 2.34^{c}	-50.40 ± 1.01^{a}	-41.85±3.28^{b}	-42.95±2.56^{b}

a,b-means followed by the same superscript letter in the same row are not significantly different (P>0.05).

in this study was similar to that reported by Bolu *et al.* (2009a) in broiler chicks. Cockerel chicks fed similar dietary inclusion level had best performance at 0.06% (Bolu *et al.,* 2009b). Increase in weight gain in laying birds fed higher doses of Alphamune G from this study agreed with the report that cumulative weight gain is a function of nutrition and that Alphamune G, in the same vein, yeast cell complex has been reported to improve feed conversion efficiency and increased body weight in chickens (Zhang *et al.,* 2005; Bolu *et al.,* 2009 a, b). Body weight, although not considered as an important laying parameter, controls feed intake and egg size. Body weight has a dramatic effect on egg size; large birds at maturity can be expected to produce large eggs throughout their laying cycle (Leeson and Summers, 2005). Results on effects of age at Alphamune G supplementation on feed intake and % hen day production agreed with the report by Leeson and Summers (2005) indicated that feed intake vary with age and egg size of the birds. However, Applegate *et al.* (1999), Schafer *et al.* (2006) and Yasmeen *et al.* (2008) reported that age of laying birds did not affect feed intake.

Table 4: Interactions of Alphamune G and Age on production characteristics, egg quality traits and percentage nutrient retention of growing pullets to laying hen

Alphamune Levels (%)	Age	Parameters: Average feed intake (g/bird/day)	Average weight gain (g/bird/day)	Feed To gain ratio	% HDP	Feed (g) per dozen egg	Feed cost(₦) per dozen egg	Average egg weight (g)
0.00	**A**	87.40^{b}	6.12	15.6^{a}	44.0	2587	176	59.90
	B	85.67^{a}	4.48	7.9^{a}	41.5	2717	185	54.88
0.04	**A**	86.30^{a}	5.35	16.7^{a}	48.5	2175	148	55.20
	B	91.30^{b}	5.60	17.1^{a}	31.9	9523	283	57.23
0.05	**A**	85.47^{a}	2.40	0.60^{a}	42.4	2572	175	55.68
	B	82.28^{a}	4.80	27.1^{b}	37.2	2970	202	57.85
0.06	**A**	88.17^{b}	4.67	19.6^{a}	53.1	2044	139	56.85
	B	83.12^{a}	2.68	13.3^{a}	40.8	2820	192	53.73
SEM		1.462	1.240	6.04	4.92	1917	32.7	1.309
Alphamune Levels (%)	**Age**	**Average shell thickness (mm)**	**Average yolk index**	**Average Haugh unit**	**% crude protein retention**	**% crude fat retention**	**% crude fiber retention**	**% crude ash retention**
		0.3617^{b}	0.4317	79.9^{a}	67.5^{b}	59.6^{b}	30.3^{b}	4.5^{b}
	B	0.3217^{a}	0.4300	76.7^{a}	69.1^{b}	66^{b}	40.2^{b}	14.8^{b}
0.04	**A**	0.2967^{a}	0.4117	73.1^{a}	36.5^{a}	26.1^{a}	-32.2^{a}	-82.5^{a}
	B	0.3300^{b}	0.4633	87.3^{b}	58.6^{b}	52.8^{a}	15.4^{b}	-18.3^{b}
0.05	**A**	0.2950^{a}	0.4433	78.0^{a}	35.9^{a}	32.2^{b}	-25.2^{b}	-77.4^{b}
	B	0.3283^{b}	0.5167	85.9^{b}	61.3^{b}	51.2^{b}	25.4^{b}	-6.3^{b}
0.06	**A**	0.3200^{a}	0.4233	83.7^{b}	53.1^{b}	60.4^{b}	13.66^{b}	-25.1^{b}
	B	0.3167^{a}	0.4150	67.5^{a}	37.9^{b}	45.4^{b}	-14.6^{b}	-64.8^{b}
SEM		0.00985	0.02433	3.47	0.329	0.317	0.25	0.298

a,b-means followed by the same superscript letter in the same column are not significantly different (P>0.05). A-Denotes growing to laying pullets of 19 weeks old at the onset of the experiment. B- Denotes growing to laying pullets of 15 weeks old at the onset of the experiment.

In an earlier study *Lactobacillus* (Lacto) administered at 8.8×10^8cfu/g in feed of laying birds significantly improved ($p<0.05$) body weight gain for corn–soybean meal and barley–corn–soybean meal diets by 24% and 21%, respectively, but had no effects on feed consumption and conversion (Nahashon *et al.,* 1994). Combination of *L. acidophilus, L. casei, B. bifidum, A. oryzae, S. faecium and Torulopsis* spp. (probiotics) used as probiotics administered at 2.7×10^5 and 5.4×10^5 cfu/g in laying birds gave a similar effect in body weight gain and feed conversion ratio in terms of feed to gain and feed per dozen eggs (Panda *et al.,* 2003). Similar trend was reported by Nahashon *et al.* (1996) that *Lactobacillus* administered at $4.84\times^{107}$ cfu/g in feed of laying birds significantly increased daily feed consumption by 2.5% during the laying phase. Result of feed intake agreed with the report of Belavi *et al.* (2001) that administering *E. faecium* at 0.5×10^6, 1.0×10^6 and1.5×10^6 cfu/g in feed of laying birds significantly reduced feed consumption and feed conversion. Aghaei *et al.* (2010) reported that both egg production and feed consumption did not differ significantly when dried whey (prebiotics) and probiotics were fed to laying birds. Khan *et al.* (2008) reported that average egg weight was not affected by dietary inclusion of 0, 2, 6 or 8% garlic powder or by 0, 2, 4, 6, 8 or 10% inclusion of garlic paste, over the six-week study period, respectively. In contrast, Yalcin *et al.* (2006) found that egg weight increased when laying hens were fed 5 and 10 g/kg garlic powder supplementation. Yoruk *et al.* (2004) and Panda *et al.* (2003) reported a contrary result of statistical significant increase of egg production in leghorn laying hens during whole laying period. Nahashon *et al.* (1996) showed that using vital biomass of probiotics supplements affect the egg weight significantly. Chen *et al.* (2005a) demonstrated an elongation of both small and large intestine in laying hens receiving fructan supplementation. This was associated with concomitant increased egg production and improved feed efficiency. Moreover, fructan supplementation increased skeletal and plasma calcium levels, resulting in increased egg shell strength (Chen and Chen, 2004) and reduced yolk cholesterol concentrations without affecting yolk weight (Chen *et al.,* 2005b). Alpharma Animal Health (2004) reported that layers fed Alphamune G produced a higher number of eggs and first quality egg than the control. Many factors have been reported to affect haugh units such as storage, time, temperature, age of birds, strain, nutrition and disease (Toussant and Latshaw, 1999). Verheyen and Decuypere (1991) observed on the contrary that haugh unit decrease with increase in age of bird. Atteh (2004) stated that egg size is influenced by strain of the bird, age at first egg, environmental temperature, age of the bird, adequacy of methionine and/or linoleic acid in the ration.

Protein and fat retention results were not similar to the report by Bolu *et al.* (2009) of no statistical significance as well as in the report that protein and fat retention values increased than the control. Once the bird starts to produce eggs, its ability to build fat reserves is greatly limited (Leeson and Summers, 2005).

Conclusion: From the experiment, it was concluded that in term of production characteristics, % nutrient retention and egg quality of experimental birds fed with inclusion levels of Alphamune G performed better than the control except for some variation in results on weight gain and feed to gain ratio. Among those fed inclusion Level of Alphamune G, birds fed inclusion levels of 0.06% performed the best in terms of production characteristics, egg quality and economic value compared to 0.04% and the recommended standard 0.05%. Age at which Alphamune G was supplemented did not have pronounced effects on the parameters measured. Mortality was observed to be least in growing to laying pullets fed diet containing 0.06% Alphamune G. From the result it can be recommended that the use of Alphamune G at a higher level of 0.06% can still give a better result in terms of egg production, egg quality, livability and economic value. It is also recommended that Alphamune G can be included in diet of growing pullets at 15 weeks old.

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