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Research Article

Effect of Oral Administration of Three Different Phytobiotics on Growth Performance of Locally-Adapted Turkeys

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Abstract

A sixteen-week trial was conducted to investigate the effect of oral administration of three different phytobiotics on growth performance of locally-adapted turkeys. Seventy five day-old turkey poults were randomly allocated to 4 experimental treatments viz: treatment 1 - without antibiotics/antibiotics (WAP); treatment 2 - 12 ml per liter of oyster mushroom extract (OME); treatment 3 - 12 ml per liter of garlic extract (GAE); treatment 4 - 12 ml per liter of ginger extract (GIE). Each treatment was sub-divided into 3 groups of 5 birds. The experiment was arranged in a completely randomized design. The result showed that treatment 4 had the highest final weight (3579.27g), weight gain (44.39g) and feed intake (161.00g) compared to other treatment groups. Treatment 4 was also superior in carcass yield. The haematological analysis indicated that treatment 2 was highest in packed cell volume (52.45%), haemoglobin (16.71 g/dl) and red blood cell (3.06 x 10^6/mm^3) counts. On the other hand, treatment 4 had the highest value of white blood cell (15.21 x 10^3/mm^3). Serum biochemical indices showed that treatment 1 had the highest serum cholesterol (187.03 mg/dl). In conclusion, the oral administration of 12 ml/L ginger extract in drinking water improved growth performance of locally-adapted turkeys without adverse effect.

Keywords: *Growth Performance; Locally-Adapted Turkeys; Phytobiotics*

Introduction

Poultry play a significant role in the livelihoods of the rural populace especially in the developing countries of world. It is a vital source of high quality animal protein for the growing population, and provides additional income to meet household needs [1,2]. Turkey production is an important and highly profitable aspect in the poultry industry with a rising global demand for its products [3]. However, turkey production in less developed economy is far below desirable levels mainly due to the menace of infectious diseases and poor management.

The use of antimicrobial growth promoters has been beneficial to maximize the efficiency of production, product quality, prevention and control of diseases in the poultry industry [4,5]. The use of antibiotics is however restricted due to the increasing resistance of pathogens, accumulation of drug residues in edible animal products. Consequently, research has become more focused on the use of naturally occurring alternatives with potential therapeutic properties as safe and cost effective approach [6,7].

Phytobiotics are the preparations of vegetative origin that are rich in wide variety of secondary metabolites, which have been used to enhance optimum performance and immune response of animals [8]. Some of the beneficial effects of phytobiotics include increment in feed intake, stimulation of digestive secretions and immune system, antimicrobial, antioxidant and coccidiostatic activity, pharmacologi-

cal actions such as laxative, spasmolytic and astringent effects as well as prevention of flatulence and denaturizing. Under the intensive management systems, herbal extracts are already being used as supplements to improve growth performance [9]. Several studies indicated that these additives could be used as antifungal, antibacterial and antioxidant compounds [10]. Prominent among these plants with medicinal properties are thyme (*Thymus vulgaris*), garlic (*Allium sativum*), ginger (*Zingiber officinale*), pepper (*Pepper nigrum*) oyster mushroom (*Pleurotus ostreatus*), spotted pumpkin (*Lagenaria breviflora*), guinea hen weed (*Petiveria alliacea*), to mention a few.

Oyster mushroom (*Pleurotus ostreatus*) is known to have antioxidant and immunomodulatory effects [11] and it improves the growth performance, immunity and intestinal health of poultry [12]. Garlic has antioxidant, antimicrobial and antiviral properties [13]. In addition, garlic (*Allium sativum*) and ginger (*Zingiber officinale*) has antioxidant, antimicrobial, antiparasitic and hypocholesteroemic properties [14]. This study therefore aimed at investigating the effect of oral administration of three different phytobiotics on growth performance, carcass characteristics and blood profile of locally-adapted turkey.

Materials and Methods

Study area

The experiment was carried out at the Turkey Unit of the Directorate of University Farms, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

Preparation of test ingredients

Oyster mushroom (*Pleurotus ostreatus*), garlic bulb (*Allium sativum*) and ginger rhizhome (*Zingiber officinale*) were purchased fresh from local markets in Abeokuta. A kilogram of oyster mushroom was boiled with 2 litres of water for 15 minutes at 60°C. It was then poured into sieve and pressed for the concentrate to be well extracted. The extract was cooled, stored in a clean air tight plastic container to prevent fermentation and deterioration [15]. Whole garlic bulbs and ginger rhizome were peeled, cut into smaller pieces, and then blended. The extracts of garlic and ginger were prepared by adding two litres of hot water to 1 kg of freshly blended garlic and ginger in separate containers. The mixtures were cooled, filtered and stored in plastic containers. Freshly prepared extracts of oyster mushroom, garlic and ginger were kept in the refrigerator at 4°C to preserve the active ingredients and for subsequent use for the birds.

Experimental birds and management

A total of seventy five unsexed one day-old (local) turkey poults were allotted to 4 experimental treatments; each treatment was subdivided into 3 replicates consisting of 5 birds. The experiment lasted for 16 weeks. The treatment groups are: treatment 1 - without antibiotics/phytobiotics in drinking water (WAP); treatment 2 - 12ml per liter of oyster mushroom extract in drinking water (OME); treatment 3 - 12 ml per liter of garlic extract in drinking water (GAE); treatment 4 - 12 ml per liter of ginger extract in drinking water (GIE). Diets fed were formulated to meet the requirements of turkey [16] as shown in table 1. Birds were fed *ad libitum*. Phytobiotics extracts were administered via drinking water at the rate of 12 ml/L on weekly basis.

Data collection

For growth performance, data on feed intake, body weight gain and percentage mortality of birds were collected on weekly basis, while the feed conversion ratio was computed. At week sixteen, 5 ml blood samples were collected from two birds on replicate basis via the jugular vein into two sets of sample tubes to analyze for haematological and serum biochemical constituents. Blood sample tubes for haematological indices contained ethylene diamine tetra acetate acid as anticoagulant, while other sample tubes for serum biochemical indices had no anticoagulant. Blood samples were then analyzed for packed cell volume, haemoglobin, red blood cell, white blood cell, serum protein, albumin, globulin, cholesterol and glucose.

Ingredient (%)	Pre starter phase (0 - 4 weeks)	Starter Phase (5 - 8 weeks)	Grower Phase (9 - 12 weeks)	Finisher phase (13 - 16 weeks)
Maize	44.0	50.0	55.0	48.0
Soybean meal	31.0	27.0	20.0	20.0
Fish meal (65% CP)	5.00	3.50	2.00	1.00
Wheat offal	10.0	12.55	7.00	20.0
Bone meal	5.60	3.30	2.50	3.50
Oyster shell	3.00	2.50	2.50	2.50
Premix*	0.40	0.50	0.50	0.30
Salt (Nacl)	0.40	0.25	0.75	0.25
DL-Methionine	0.40	0.20	0.10	0.20
Lysine	0.20	0.20	0.15	0.10
Total	100	100	100	100
Calculated analysis				
Metabolizable energy (MJ/kg)	11.70	12.12	13.17	12.54
Crude protein	28.0	26.0	23.0	19.0

Table 1: *Gross composition of diets.*

**Vitamin/Mineral Premix contains Vitamin A, 10 000 000iu; E, 12 500iu; K, 1.3g; B_1 1.30; B_2 4.00g; D Calcium-Pantothenate, 1.30g; B_6 1.30g; B_{12} 0.01g; nicotinic acid, 15.00g; folic acid, 0.05g; biotin, 0.02g; Co, 0.20g; Cu, 5.00g; Fe, 25.00g; I, 0.06g; Mn, 48.00g; Se, 0.10g; Zn, 45.00g; Choline chloride, 200.00g; BHT, 50.00, CP: Crude Protein.*

At the end of the trial (16th week), two birds per replicate were randomly selected, starved over night and then slaughtered for carcass evaluation. Carcasses were eviscerated, dissected into cut-up parts and then weighed using an electronic weighing scale. The corresponding percentages of live body weight were calculated.

Statistical analysis

Data obtained were subjected to a one way analysis of variance in a completely randomized design. Significant ($p < 0.05$) differences among treatment means were separated using Tukey Test as contained in Minitab® version 17.1.0 [17].

Results and Discussion

The effect of oral administration of phytobiotics on overall growth performance of locally-adapted turkeys is presented in table 2. From the result, it was observed that treatment 4 (locally-adapted turkeys administered 12m/L of ginger extract in drinking water, GIE) had the highest significant increase in the final weight (3579.27g), weight gain (44.39g) and feed intake (161.00g) compared to other treatment groups. However, treatment 2 (locally-adapted turkeys administered 12 ml/L oyster mushroom extract, OME), competed favourably in final weight (3556.18g), weight gain (45.67g) and feed intake (160.00g) with treatment 4. The significant increase in the final weight gain, weight gain and feed intake of locally-adapted turkeys administered 12ml/L ginger extract (GIE) in drinking water may be due to the bioactive components of ginger which promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of nutrients, thereby leading to improved growth [18]. This result is in agreement with the report of [19] which indicated that ginger enhances feed intake, which in turn is reflected in heavy final body weight of birds. Also, this is in consonance with the findings of [20] whose reports showed pronounced improvement in body weight gain of poultry when administered ginger (*Zingiber officinale*) as natural alternatives to antibiotic growth promoters. In addition, it was also observed that phytogenics inhibits and limits the growth and

colonization of numerous pathogenic species of bacteria in the gut due to antimicrobial activity. Thus, when the number of these harmful bacteria in the intestinal tract is low, it promotes the assimilation of nutrients and consequently, improved performance of monogastric animals [21]. On the other hand, treatment 3 (locally-adapted turkeys administered 12 ml/L garlic extract, GAE) recorded the best feed conversion ratio (3.46) across the treatment groups. The significant effect of phytobiotics on the feed conversion ratio of birds administered 12 ml/L garlic extract (GAE) in drinking water contradicts the result of [22,23] which stated that phytobiotic additives in poultry species reduced feed intake and improved feed conversion ratio.

The oral administration of phytobiotics also had significant influence on the carcass yield of locally-adapted turkeys (Table 2). The correlation between growth performance and carcass characteristics of poultry has been previously reported [24]. The result showed that birds administered 12 ml/L ginger extract (GIE) were superior in carcass yield. However, all phytobiotic-treated groups showed significant increase compared to the other group. The higher dressing percentage and cut-up parts observed in phytobiotic-treated groups could be attributed to better live weights of the birds which reflected as a result of the effect of positive effect of phytobiotics on growth index. The result of this present study contradicts [18,25] who reported that medicinal plants had no positive effect on carcass yield. However [26] reported a significant effect on carcass yield of broilers fed herbs.

Parameter	Treatment 1- Control (WAP)	Treatment 2 (12ml/L OME)	Treatment 3 (12ml/L GAE)	Treatment 4 (12ml/L GIE)	SEM
Growth performance					
Initial weight (g)	60.49.00	61.07	60.17	60.32	0.41
Final weight (g)	3100.29^{d}	3556.18^{b}	3551.54^{bc}	3579.27^{a}	1.16
Weight gain (g/b/d)	36.20^{d}	45.67^{b}	46.29^{a}	44.39^{c}	0.04
Feed intake (g/b/d)	145.00^{c}	160.00^{b}	160.00^{b}	161.00^{a}	0.04
Feed conversion ratio	4.03^{a}	3.52^{c}	3.46^{d}	3.64^{b}	0.001
Feed: water	12.95^{a}	12.38^{b}	11.83^{c}	11.76^{cd}	0.21
Carcass characteristics					
Live weight (g)	3092.26^{c}	3528.72^{b}	3529.69^{b}	3569.59^{a}	0.84
Dressing percentage	72.26^{c}	76.21^{d}	76.45^{ab}	76.53^{a}	0.08
Breast	14.20^{d}	16.15^{ab}	16.14^{c}	16.21^{a}	0.02
Thigh	11.41^{b}	12.45^{a}	12.47^{a}	12.50^{a}	0.02
Drumstick	11.46^{c}	13.38^{ab}	13.43^{a}	13.43^{a}	0.02
Wings	9.32^{c}	9.84^{ab}	9.86^{a}	9.89^{a}	0.02
Neck	5.47^{a}	5.12^{c}	5.27^{b}	5.29^{b}	0.02
Back	12.83^{a}	12.29^{b}	12.26^{b}	12.31^{b}	0.04

Table 2: *Overall growth performance and carcass characteristics of locally-adapted turkeys orally administered phytobiotics.*

$^{a, b, c, d}$ *Means on the same row with different superscripts are significantly different at p< 0.05*

SEM: Standard Error of Mean; WAP: Without Antibiotics/Phytobiotics; OME: Oyster Mushroom Extract; GAE: Garlic Extract; GIE: Ginger Extract.

The effect of oral administration of phytobiotics on haematological and serum biochemical indices of locally-adapted turkeys is shown in table 3. The result indicated that treatment 2 (locally-adapted turkeys orally administered 12 ml/L oyster mushroom extract, OME) was highest in packed cell volume (52.45%), haemoglobin (16.71 g/dl), and red blood cell counts (3.06 x 10^{6}/mm^{3}). Treatment 4 (birds

administered 12 ml/L ginger extract, GIE) recorded the highest value of white blood cell (15.21 x 10^3/mm^3). Blood is an important index of physiological, pathological and nutritional status of animals [27]. There is an indication that the oral 12 ml/L administration of oyster mushroom (OME) in locally-adapted turkeys (treatment 2) enhanced better transportation of nutrients and oxygen which resulted from increased packed cell volume, haemoglobin and red blood cell [28]. In the same vein, it was observed that the extract of oyster mushroom boosted immune response as a result of the highest value of white blood cells recorded for birds in treatment 2; thus, they were less susceptible to infections and diseases. The serum biochemical indices showed that treatment 1 (control- locally-adapted turkeys without antibiotics/phytobiotics, WAP) was highest in serum total cholesterol (187.03 mg/dl) compared to other treatments. It was observed that treatment 3 (birds administered 12 ml/L garlic extract, GAE) recorded the lowest value in serum cholesterol (129.00 g/dl) as a result of inhibitory effects of the essential oil contained in garlic which acts against hypolipidemic activities [29]. This indicated that garlic has modulatory effect on serum cholesterol and lipid metabolism and can elicit hypocholesterolemic effects [30,31] also reported that garlic depressed hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme and fatty acid synthase.

Parameter	Treatment 1- Control (WAP)	Treatment 2 (12ml/L OME)	Treatment 3 (12 ml/L GAE)	Treatment 4 (12 ml/L GIE)	SEM
Haematogical indices					
Packed cell volume (%)	44.07^{b}	52.45^{a}	43.43^{c}	41.02^{d}	0.30
Haemoglobin (g/dl)	15.23^{b}	16.71^{a}	14.31^{d}	14.01^{d}	0.01
White blood cell (x 10^3/mm^3)	11.42^{c}	10.91^{d}	12.76^{b}	15.21^{a}	0.01
Red blood cell (x 10^6/mm^3)	2.53^{b}	3.06^{a}	2.43^{c}	2.32^{d}	0.01
Serum biochemical indices					
Cholesterol (mg/dl)	187.03^{a}	152.00^{b}	129.00^{d}	136.00^{c}	0.01
Glucose (g/dl)	238.00^{a}	147.00^{d}	176.00^{c}	207.00^{b}	0.01
Total protein (g/dl)	3.92^{bc}	4.12^{b}	5.60^{a}	4.12^{b}	0.01
Albumin (g/dl)	1.71^{d}	2.02^{c}	3.12^{s}	2.41^{b}	0.01
Globulin (g/dl)	2.23^{b}	2.10^{c}	2.51^{a}	1.70^{d}	0.01

Table 3: *Haematological and serum biochemical indices of locally-adapted turkeys orally administered phytobiotics.*

$^{a, b, c, d}$ *Means on the same row with different superscripts are significantly different at p< 0.05*

SEM: Standard Error of Mean; WAP: Without Antibiotics/Phytobiotics; OME: Oyster Mushroom Extract; GAE: Garlic Extract; GIE: Ginger Extract.

Conclusion

The study concluded that the oral administration of 12 ml/L ginger extract in drinking water enhanced improved growth and health status of locally-adapted turkeys without adverse effect.

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