GROWTH PERFORMANCE, HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF COCKEREL CHICKS FED GINGER *(Zingiber officinale)* ADDITIVE IN DIETS

[1]KEHINDE, A. S., [2]OBUN C. O., [3]INUWA, M. and [4]BOBADOYE, O.

[1, 3, 4]Forestry Research Institute of Nigeria, Jericho, Ibadan, Oyo State.

[2]Department of Animal Production Technology, Federal College of Wildlife Management, PMB 268, New Bussa, Niger State, Nigeria.

Corresponding Author: Obun, C. O. Department of Animal Production Technology, Federal College of Wildlife Management, PMB 268, New Bussa, Niger State, Nigeria. **Email:** obunotu@yahoo.com **Phone:** ±234 8032452529

ABSTRACT

An experiment was conducted to evaluate the effects of graded levels (0, 1.5, 3.0 and 4.5%) of ginger in the diets of cockerel chicks on growth performance and haematological and serum biochemical parameters. Two hundred and sixty four-two week old cockerel chicks used for the trial were randomly allotted to four treatments (T_1 T_2, T_3, T_4) at 66 chicks per treatment, each treatment was replicated six times (11 birds per replicate). The diets were isocaloric and isonitrogenous (2400kcal/kg M.E and 21% crude protein). The trial lasted for seven weeks. Results elicited that ginger supplementation at 0, 1.5, 3.0 and 4.5 % had no adverse effect on feed intake, weight gain, feed conversion ratio, haemoglobin count, white blood cell count and lymphocyte count. Packed cell volume (28.0 ± 3.0%), Red blood cell count (2.2 ± 0.4 (x 10^9/1) and urea (4.5 ± 1.7 mg dl^{-1}) were significantly varied ($P < 0.05$); while the levels of creatinine increased significantly beyond 1.5% ginger inclusion level. Inclusion of ginger at 1.5 – 3.0% levels had no adverse effects on the growth performance and blood constituents of cockerel chicks. The use of ginger for cockerel diet is therefore advocated.

Keywords: Cockerel, Growth performance, Haematology, Biochemical indices, Ginger inclusion

INTRODUCTION

Animal protein is essential in human nutrition, due to its balanced amino acid profile and ease of utilization (Tewe, 1997). Shortage of the vital nutrient source has been reported in most parts of Africa (Agunbiade *et al*., 2000). Poultry production presents the fastest means of correcting the shortage of animal proteins in Africa (Oluyemi and Roberts, 1988). This is because of their short generation interval, high rate of reproduction and also characterized by the best efficiency of nutrient transformation into high quality animal protein (Akinfala *et al*., 1999). The production of poultry products, such as eggs and meat has been sustained with the use of antibiotics and growth promoters, used at therapeutic doses in animal feeds in order to improve the quality of the products (NOAH, 2001). Birds raised with these feed additives achieved good performance, their potential side effects present a real public health problem worldwide (Donoghue, 2003), that led to the ban of these products by European Union in January 2006. This decision has therefore stimulated a search for natural alternative feed additives, such as ginger, garlic and onion etc. Ginger root contains a number of compounds that exert varying biological activities, including antioxidant (Nakatani, 2000; Rababah, *et al*., 2004), antimicrobial (Akoachere *et al.,* 2002; Jegetia *et al*., 2003; Mahady *et al*., 2003), and various pharmacological effects (Chrubasik *et al*., 2005; Ali *et al*., 2008). Powdered rhizome of

ginger has long been used as traditional medicine to alleviate the gastrointestinal illnesses (Afzal *et al*., 2001). Ginger has been found to enhance pancreatic lipase activity (Platel and Srinivasan, 2000), intestinal lipase, disaccharides, sucrose and maltase activities of rat (Platel and Srinivasan, 1996). All of these have favorable effects on gut function, which is the primary mode of action for growth-promoting feed additives (Windisch *et al*., 2008). The use of feed additives, such as ginger and garlic in livestock feed and human diets are becoming more popular, because of their beneficial health and preservative importance (Joke and Susan, 2007). Hence, this study was aimed at investigating the effects of graded levels of ginger on growth performance, some haematological and serum biochemistry indices of cockerel chickens.

MATERIALS AND METHODS

Experimental Birds: The study was conducted in the poultry unit of Federal College of Wildlife Management, New Bussa, Niger State, Nigeria. Two hundred and sixty four, two-week old white cockerel chicks were randomly allotted to four treatments, at twenty two birds per treatment, while each treatment was replicated six times. The chicks were raised on dip litter system. The housing unit was partitioned to accommodate replicated birds. It was cleaned and disinfected with IZAL solution two weeks prior to the arrival of the chicks.

Gingerized Diets: The ginger used for the feeding trial was sourced from farmers in New Bussa, Niger State, North Central Nigeria. The bulbs were washed, sun dried, cleaned and milled to powder. It was incorporated in the four diets adopted. The control diet had no dinger additive, while the three supplemented diets contained ginger at 1.5, 3.0 and 4.5 % and presented as diets T_1, T_2, T_3 and T_4, respectively (Table 1). The experimental diets were analyzed for dry matter, nitrogen, ether extract, ash and crude fibre. Crude protein was determined by multiplying the value for nitrogen by 6.25, using (AOAC, 1990) method.

Management of Experimental Cockerel Chicks: The chicks were offered experimental diets and water *ad libitum.* The feed intake was determined as the differential between the quantity of feed served and left over. The weight gain was determined by weighing chicks initially and thereafter on a weekly basis until termination of the experiment.

Haematology and Serum Biochemistry: Blood collection was carried out at the 7^{th} week of the experiment. Three birds per replicate were randomly selected and bled via wing veins, using sterile gauge 19 needles and syringes. About 5ml of blood was collected into two sets of three sterile glass tubes, for each replicate. The samples collected for haematological parameters determination were in bottle tubes containing ethylene diaminetetra-acetic Acid (EDTA). Blood samples for serum biochemical studies were collected into plain bottles (i.e. without anticoagulant) for serum separation. Serum was obtained by centrifugation and the serum samples were stored in a deep freezer at (-10^0C) until analyzed.

Packed cell volume (PCV) was determined by microhaematocrit method (Igene and Iboh, 2004). Haemoglobin (Hb) concentration was measured spectrophotometrically using SP6-500 UV spectrophotometer. The red blood cells (RBC) and white blood cell (WBC) counts were estimated using haemocytometer. Serum indices were analyzed using sigma kits as reported by (Igene and Iboh, 2004).

Statistical Analysis: Data from parameters investigated were analyzed in a completely randomized design, using the procedure of SAS (1988). Model sums of squares were partitioned to test linear, quadratic and cubic trends (Gomez and Gomez, 1983).

RESULTS AND DISCUSSIONS

The proximate composition of the experimental diets (Table 1) showed that the four diets adopted for the feeding trials had comparable proximate composition, despite the dietary inclusion of ginger at graded (0, 1.5, 3.0, 4.5%)

levels fed to cockerel chicks. The range values for dry matter (90.40-90.77%), crude protein (20.49 - 20.97 %) and metabolizable energy levels (2399 – 2405 Kcal/kg) were within the range recommended by Oluyemi and Roberts (1988).

Table 1: Composition of gingerized diet fed to two-week old white cockerel chicks

Ingredients	Dietary ginger inclusion levels			
	0.00% (T_1)	1.5 % (T_2)	3.0% (T_3)	4.5% (T_4)
Maize	50.00	49.00	48.00	47.50
Maize offal	7.5	7.00	6.50	5.50
Ginger spice	0.00	1.50	3.00	4.50
GNC	6.00	6.00	6.00	6.00
Soybeans	25.00	25.00	25.00	25.00
Fish meal	6.00	6.00	6.00	6.00
Bone meal	3.00	3.00	3.00	3.00
Oyster shell	1.50	1.50	1.50	1.50
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Calculated nutrients (% DM basis)				
Crude protein	21.26	21. 10	21. 07	21.22
Dry matter	90.49	90.68	90.77	90.72
Crude protein	20.97	20.49	20.57	20.69
Ether extracts	3.58	3.63	3.61	3.74
Crude fibre	5.77	5.70	5.76	5.78
Ash	4.43	4.41	4.48	4.53
Nitrogen free extracts	55.74	56.45	56.35	55.98
ME (Kcal/kg)	2401.00	2399.00	2405.00	2400.00

The weekly feed intake values of 52.27 ± 5.50g, 49.67 ± 5.00g, 51.62 ± 5.53g and 54.54 ± 5.45g recorded in T_1, T_2, T_3 and T_4 were not significantly ($P > 0.05$) different from each other, implying that ginger inclusion did not impaired feed intake (Table 2). However a marginal increase was recorded in feed intake in T_4, with the intake increasing from 49.67 ± 5.00g in T_2 to 55.54 ± 5.45g in T_4. There was decreased feed intake in groups T_2 and T_3. The stimulation of feed across the treatments could be attributed to the pleasant aroma and flavour imparted on the feed by ginger (Shivani and Sadhana, 2005).

The body weight gain values of 23.37 ± 1.24g, 23.70 ± 1.41g, 24.67 ± 1.38g and 23.37 ± 1.40g for diets T_1, T_2, T_3 and T_4 were similar ($P > 0.05$) across the treatments (Table 2). The non significant difference in the weight gain of birds among the treatments could be linked to the non significant effect of dietary ginger on the feed intake thus positive correlation between feed intake and body weight gain (Diemou *et al.,* 2009). The numerical improved weight gain and decreased in feed intake by cockerel chicks fed diets T_2 and T_3 compared with birds fed diet T_4 may be due to increased levels of ginger in diets. *Zingiber officinale* has been reported for its various medicinal properties such as analgesic, anti-helmintic, anti ulcer, antipyretic and cardio-depressant among others (Philips *et al.*, 1993). This observed result is similar to those reported by El-Deek *et al.*, 2002) that diet containing 1 g/kg of ginger meal did not affect the growth performance, whereas Farinu *et al.*, 2004) reported that supplementation of ginger at the levels of 5, 10, or 15 g/kg slightly improved growth performance of broilers. In contrast, Al-Homidan (2005) observed reduced growth rate of starter broilers (1 to 4 week) when ginger was fed at the rates of 20 and 60 g/kg. These results suggest that growth performance of cockerel chicks may respond to ginger supplementation in a dose-dependent manner. The weight gain reduction in birds fed 4.5% dietary ginger meal means that herbal additives have their limitations too.

Feed conversion ratio improved from T_1 to T_3 while the utilization efficiency reduced beyond 3% ginger inclusion (Table 2). This results was similar to those recorded in broiler chicks fed high inclusion levels of wheat offal supplemented with garlic at 4 % (Abubakar *et al.*, 2002), a similar spice like ginger.

Table 2: Performance of two-week old white cockerel chicks fed gingerized diet

Parameters	Diets				Probability[a]		
	T_1	T_2	T_3	T_4	L	Q	C
Weekly feed intake, g	52.27 ± 5.50	49.67 ± 5.00	51.62 ± 5.53	54.54 ± 5.45	NS	NS	NS
Weekly weight gain, g	23.37 ± 1.24	23.70 ± 1.41	24.67 ± 1.38	23.37 ± 1.40	NS	NS	NS
Feed conversion ratio	2.24 ± 0.24	2.10 ± 0.20	2.09 ± 0.22	2.33 ± 0.21	NS	XX	NS

NS: Not significant, a: Probability for Linear (L), quadratic (Q) and cubic (C) trends, XX: P<0.05

Table 3: Haematological variables of two-week old white cockerel chicks fed gingerized diet

Parameters	Diets				Probability[a]		
	T_1	T_2	T_3	T_4	L	Q	C
Pack cell volume, %	25.00 ± 0.04	26.00 ± 0.06	27.00 ± 0.06	28.00 ± 0.08	XX	NS	NS
Haemoglobin, g/dl	7.40 ± 0.01	8.30 ± 0.01	9.50 ± 0.01	9.50 ± 0.01	NS	NS	NS
Red blood cell, × 10^9/l	1.80 ± 0.01	2.00 ± 0.03	2.15 ± 0.02	2.20 ± 0.01	XX	NS	NS
White blood cell, × 10^9/l	209.00 ± 0.20	220.00 ± 0.18	220.00 ± 0.18	225.00 ± 0.19	NS	NS	NS
Lymphocytes, × 10^9/l	2.11 ± 0.01	2.20 ± 0.01	2.20 ± 0.01	2.20 ± 0.01	NS	NS	NS

NS: Not significant a: Probability for Linear (L), quadratic (Q) and cubic (C) trends XX: P<0.05

Table 4: Serum metabolites of two-week old white cockerel chicks fed gingerized diet

Serum metabolites	Diets				Probability[a]		
	T_1	T_2	T_3	T_4	L	Q	C
Urea (mgdl^{-1})	2.80 ± 0.001	3.22 ± 0.011	4.00 ± 0.031	4.50 ± 0.051	XX	NS	NS
Creatinine (mgdl^{-1})	117.60 ± 0.044	108.10± 0.025	128.00 ± 0.05	128.00 ± 0.05	XX	NS	XX

NS: Not significant, a: Probability for Linear (L), quadratic (Q) and cubic (C) trends XX: P<0.05

The results of the haematological indices of cockerel chicks fed the gingerized diet compared favourably with the control (T_1) (Table 4). The slight increase in the blood constituents of cockerel chicks with increased concentration of ginger may be associated with the effects of ginger bioactive compounds on improving antioxidant status of the bird (Nakatani, 2000; Rababah *et al*., 2004) and improving protein and fat metabolism (Platel and Srinivasan, 2000).

Ginger roots have been reported to contain a number of compounds that exert varying biological activities, including antioxidant (Nakatani, 2000; Rababah *et al*., 2004), antimicrobial (Akoachere *et al*., 2002; Jagetia *et al*., 2003; Mahady *et al*., 2003) and various pharmacological effects (Chrubasik *et al*., 2005; Ali *et al*., 2008). Powdered rhizome of ginger has long been used to alleviate the symptoms of gastrointestinal illnesses as traditional medicine (Afzal *et al*., 2001). Ginger has been found to enhance pancreatic lipase activity (Platel and Srinivasan, 2000), intestinal lipase, disaccharidase, surcease and maltase activities in rat (Platel and Srinivasan, 1996). All of these have favorable effects on gut function, which is the primary mode of action for growth-promoting feed additives (Windisch *et al*., 2008).

The results of the serum biochemistry (Table 4) revealed significant increase in urea from 2.80 ± 0.001 mg dl^{-1} in T_1 to 4.50 ± 0.051 mg dl^{-1} in T_4. The level of creatinine in birds fed the control diet (T_1) 117.60 ± 0.044 $mgdl^{-1}$ reduced to 108.10 ± 0.025 $mgdl\text{-}^{1}$ in T_2, this however rose to 128.00 ± 0.05 $mgdl^{-1}$ in T_3 and T_4 respectively. The level of urea and creatinine is a measure of tissue degeneration, which is a sign of tissue wear-down (Ranjna, 1999). These increased in urea and creatinine may be an indication of possible kidney damage (Ranjna, 1999).

Conclusion: In this study, ginger additive was safe up to 3 % level of inclusion in cockerel chick's ration without any adverse effect on performance, haematological and some biochemical constituents. Cockerel chicks fed 4.5 % ginger additive showed reduce performance with increased blood constituents, suggesting that dietary herbal additives have their limitation with consequence at a long run. Inclusion of ginger additive spice beyond 4.5 % in cockerel chicks' needs further investigation.

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