Variations in haematological and serum indices of finishing broiler birds fed neem (*Azadirachta indica*) and garlic (*Allium sativum*) as phytobiotics

Muhammad¹, S. B., * Sobayo¹, R. A., Sogunle², O. M., Oso¹, A. O. and Adeyemi², O. A.

¹Department of Animal Nutrition, ²Department of Animal Production and Health, Federal University of Agriculture, Abeokuta

*Correspondence author: rasobayo@yahoo.com

Abstract

One hundred and eighty day-old Cobb broiler chickens were used to evaluate the effects of feeding diets containing neem leaf meal (NLM), garlic meal (GM) and their combination (NLM + GM) on haematological and serum indices of finishing broiler. The birds were divided into twelve treatment groups of fifteen chicks with three replicate of five chicks each. The diets contained NLM, GM and NLM + GM at four levels of inclusion; 0mg/kg, 500mg/kg, 1000mg/kg and 1500mg/kg. The experiment was arranged in a 3 × 4 factorial layout in a completely randomized design (CRD). The inclusion of NLM, GM and NLM + GM did not significantly ($P > 0.05$) influence haematological parameters. Different levels of inclusion significantly ($P < 0.05$) influenced absolute haematological parameters. ($P < 0.05$) interaction of additives and levels of inclusion were observed in most of the haematological indices studied. NLM+GM at 500mg/kg showed the highest PCV value. Highest Hb and RBC values were observed in birds fed GM at 1500mg/kg. Different levels of inclusion significantly ($P < 0.05$) influenced total protein and albumin levels. Lowest ($P < 0.05$) amounts of total protein (8.88mg/dl) and albumin (2.20mg/dl) were recorded in birds fed 1500mg/kg inclusion levels compared to those birds on 0mg/kg inclusion level. Additives and levels of inclusion ($P < 0.05$) affected cholesterol value of finishing broiler birds. There was a reduction in cholesterol (93.38mg/dl) and HDL (52.57mg/dl) values of birds fed GM than those fed NLM + GM. Significant ($P < 0.05$) interactions were observed in alanine aminotransferase (ALT), urea, cholesterol and low density lipoprotein (LDL) values. It was evident that feeding of the additives at different levels affected the blood picture of the finishing broiler chickens.

Keywords: Neem, garlic, finishing broilers, serum, haematology.

Introduction

In modern animal feeding, the use of antimicrobial growth promoters (AGP) has led to the abandonment of herbs and spices. The benefits of AGP in improving weight gain and feed efficiency of broiler chickens are well established (Butaye *et al.*, 2003). The long term side effects of these products such as microbial resistance and increased blood cholesterol level of animals led to the ban of these commercial antibiotics (Mansoub, 2010). Nevertheless, the prohibition of most AGPs has necessitated

renewed interest in plant extracts in animal feed strategies (Charis, 2000). The positive effects of herbal plants on broilers have been reported by Tekele *et al.* (2006). The mechanism of phyto-genic additives has not been explained entirely, and Cross *et al.* (2007) pointed out that the efficiency of phyto-genic additives depends on differences in their chemical composition while Ciftci *et al.* (2005) reported that broiler response to phyto-genic compounds could be related to their inclusion level in the diet and variety of Essential Oils (EO)

products. Reuter *et al.* (1996) reported garlic as a plant with antibiotic, anticancer, antioxidant, immune-modulatory, anti-inflammatory, hypoglycemic and cardiovascular-protecting effects. Active components in garlic like Ajoene, S-allyl cysteine, di allyl (di/ three) sulfide are the most active one (Rahmatnejad 2009). Allicine possibly reduces LDL, triglyceride and cholesterol in serum (Alder *et al.*, 1997). Neem leaves and its constituents have been demonstrated to exhibit immuno-modulatory, anti-inflammatory, anti-hyperglycaemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, anti-oxidant, anti-mutagenic and anti-carcinogenic properties (Subapriya and Nagini, 2005). In pursuit of improved broilers health and in order to fulfil consumer expectation in relation to food quality there is a need to explore the medicinal properties of natural herbs (Gardzielewska *et al.*, 2003). This study was therefore, conducted to evaluate the effects of neem and garlic and their combination on blood parameters of finishing broiler chickens.

Materials and Methods

This experiment was carried out at the Directorate of University Farms, Federal University of Agriculture, Abeokuta, Ogun State. The area lies on latitude 7°10'N and longitude 3° 2'E. It is 76m above sea level and located in the tropical rain forest vegetation zone with an average temperature of 34.7°C and relative humidity of 82% (Google Earth, 2012). *Allium sativum* (garlic) powder was prepared by cutting garlic bulbs into small pieces, followed by sun-drying for 14 days ($\leq 90\%$ DM) and pulverised using laboratory mill (1mm sieve) while *Azadirachta indica* leaves were removed from the stalk and air dried under a shed ($29\pm 2^\circ\text{C}$) until they are

crispy to touch, while still retaining their greenish colouration, milled using a laboratory mill (1mm).

Management of experimental birds and diets

Twelve experimental diets were formulated with the inclusion of neem, garlic and their combination for finishing broiler. Diets 1 - 4 contained NLM at 0 mg/kg, 500 mg/kg, 1000 mg/kg, and 1500 mg/kg, diets 5 - 8 contained GM at 0 mg/kg, 500 mg/kg, 1000 mg/kg, and 1500 mg/kg, diets 9 - 12 contained combinations of NLM + GM at 0 mg/kg, 500 mg/kg, 1000mg/kg and 1500mg/kg. One hundred and eighty (180) unsexed day old Cobb broilers of a commercial strain were used for the experiment. They were divided into twelve treatment groups of fifteen birds after balancing for live weight. Each treatment group was replicated thrice with five birds per replicate in a 3×4 factorial experimental design. Brooding of birds was done for three weeks using charcoal and electric bulbs as sources of heat. The birds were fed *ad libitum* and managed intensively throughout 8 weeks experimental period.

Data collection

At 8th weeks of the study, 2.5ml of blood was collected via wings from a bird per replicate into labelled sterile universal bottles containing (EDTA) as anticoagulant. These were used to determine the haematological components as described by (Davice and Lewis, 1991). Another 2.5 ml of blood was collected into labelled sterile sample bottles without anticoagulant and used to determine the serum biochemical indices following standard clinical procedures (Olorede *et al.*, 1996). Cholesterol content of blood was determined using analytical method as described by Coles (1986).

Table 1: Gross Composition % of experimental Diets (Starter mash)

Ingredients	Dietary treatments				NLM (mg/kg)				GM (mg/kg)				GM+NLM (mg/kg)			
	0	500	1000	1500	0	500	1000	1500	0	500	1000	1500	0	500	1000	1500
Maize	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Wheat offal	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
SBM	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
PKC	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
GNC	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30
FM (72%)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Oyster shell	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
GM	-	-	+	+++	-	-	-	-	-	-	-	-	-	-	-	-
NLM	-	-	-	-	-	-	+	++	-	-	++	+++	-	-	-	-
NLM +GM	-	-	-	-	-	-	-	-	-	-	-	-	+	-	++	+++
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Chemical Composition (%)																
ME(kcal/kg)	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13	2835.13
Crude Protein	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40	22.40
Crude Fibre	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98
Fat	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29
Calcium	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66
Phosphorus	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82

Table 2: Gross Composition % of experimental Diets (Finisher mash)

Dietary treatments	NLM (mg/kg)				GM(mg/kg)				GM+NLM(mg/kg)			
	0	500	1000	1500	0	500	1000	1500	0	500	1000	1500
Ingredients												
Maize	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Wheat offal	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
SBM	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
PKC	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
GNC	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30
FM (72%)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Oyster shell	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
GM	-	+	++	+++	-	-	-	-	-	-	-	-
NLM	-	-	-	-	-	+	++	+++	-	-	-	-
NLM + GM	-	-	-	-	-	-	-	-	-	+	++	+++
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Chemical Composition (%)												
ME(kcal/kg)	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33	2875.33
Crude Protein	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24
Crude Fibre	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03
Fat	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27	4.27
Calcium	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Phosphorus	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82

Statistical analysis

Data collected were subjected to 3×4 factorial arrangement in a completely randomized design. Significant ($p < 0.05$) differences among treatment means were determined using Duncan Multiple Range Test as contained in Statistical Analysis Software (SAS, 2000) package.

Results

Haematological parameters of broiler chickens fed NLM, GM, NLM + GM and levels of inclusion are presented in Table 3. There was no significant ($P > 0.05$) effect of NLM, GM and NLM + GM on haematological indices of birds. Levels of inclusion revealed significant ($P < 0.05$) effect on eosinophil, mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC). Eosinophil of birds on 500mg/kg levels of inclusion had the highest value (0.83%) compared to those of birds on 0mg/kg. MCHC of birds on 1500mg/kg recorded the highest value (29.78g/dl) which was statistically similar to birds on 1000mg/kg (29.25g/dl). Table 4 revealed interaction effects of broiler chicken fed NLM, GM, NLM + GM and levels of inclusion on haematological parameters. Results showed significant ($P < 0.05$) effect on haematological parameters. *NLM+GM at 500mg/kg showed the highest PCV and WBC values. Highest Hb and RBC values were observed in birds fed GM at 1500mg/kg.* Table 5 showed main effects of phytobiotics and inclusion levels on serum parameters of finishing broiler chickens. There was significant ($P < 0.05$) increased cholesterol (101.25mg/dl) and HDL (61.55mg/dl) levels in birds fed NLM+GM compared to other treatments. Total protein, albumin and AST values showed ($P < 0.05$) higher values at 0mg/kg level of inclusion compared to 1500mg/kg. Table 6

revealed interaction effect of additives and levels of inclusion on serum parameters of finishing broiler chickens. Significant ($P < 0.05$) effects were observed in alanine aminotransferase (ALT), urea and cholesterol values. NLM at 1000mg/kg level revealed highest value of ALT.

Discussion

The non-significant effect of additives on haematological values reported in finishing broiler fed the various additives could infer that the haematological indices were within safety limits for broilers in this experiment. The observed PCV and Hb values were within the reference range 24.9 - 45.2% for healthy birds reported by (Mitruka and Rawnsley 1977). The significant difference observed in the mean WBC values of birds could be due to differences in the intrinsic body defence system (Ganong 1991). The normal haematological values portray the nutritional status of the broiler chicken and thus indicating adequate nourishment of the birds (Church *et al.*, 1984). MCV values were better than the reference range of 60.0fl - 65.7fl (Ayoola *et al.*, 2010). Observed MCH values were higher than the range of 19.29 - 23.20pg reported by (Ayoola *et al.*, 2010). And MCHC values were less than the reference range of 31.90 - 35.52% reported by (Ameen *et al.* 2007). Several factors including physiological (Alodan and Mashaly, 1999), environmental conditions (Vecerek *et al.*, 2002, Graczyk *et al.*, 2003) and diets (Odunsi *et al.*, 2002) have been reported to be responsible for variation in haematological parameters. The result of levels of inclusion on the total protein value was within the range of 3.25g/dl - 7.61g/dl reported by Rajurker *et al.* (2009). Observed value was normal and therefore, suggests that the experimental birds were

Table 3: Main effects of NLM, GM, NLM + GM and Inclusion levels on Haematological parameters of finishing broiler chickens

Parameters	Additives				Levels of inclusion (mg/kg)				
	NLM	GM	NLM + GM	SEM	0	500	1000	1500	SEM
PCV (%)	24.25	23.88	24.25	1.325	25.00	23.33	24.83	23.33	1.53
Hb (g/dl)	6.43	6.78	6.88	0.365	6.40	6.17	7.25	6.95	0.42
RBC ($\times 10^{12}/l$)	1.88	1.81	1.76	0.112	1.85	1.60	1.97	1.85	0.13
WBC ($\times 10^9/l$)	10.54	10.61	10.65	0.338	10.05	10.78	10.35	11.22	0.39
HET (%)	30.88	28.13	28.38	1.502	30.50	29.00	28.67	28.33	1.73
LYM (%)	67.63	70.50	70.25	1.452	68.50	69.33	70.00	70.00	1.68
EOS (%)	0.38	0.25	0.50	0.191	0.00 ^b	0.83 ^a	0.17 ^{ab}	0.50 ^{ab}	0.22
BAS (%)	0.50	0.50	0.38	0.217	0.50	0.33	0.33	0.67	0.25
MONO (%)	0.63	0.63	0.50	0.270	0.50	0.50	0.83	0.50	0.31
MCV (fl)	130.75	133.78	137.95	3.716	134.65 ^{ab}	146.35 ^a	127.45 ^b	128.18 ^b	4.29
MCH (Pg)	47.24	51.21	51.53	12.185	84.80 ^a	39.95 ^b	37.37 ^b	37.85 ^b	14.07
MCHC (g/dl)	26.56	28.53	28.41	0.944	25.80 ^b	26.50 ^{ab}	29.25 ^a	29.78 ^a	1.09

^{ab} means on the same row having different superscript were significantly different ($P < 0.05$)

GM= Garlic Meal NLM= Neem Leaf Meal GM= Garlic Meal NLM= Neem Leaf Meal PCV: Packed cell volume Hb: haemoglobin
RBC: Red blood cell WBC: White blood cell HET: Heterophil LYM: Lymphocyte EOS: Eosinophil BAS: Basophil MONO: Monocyte
MCV: Mean corpuscular volume MCH: Mean corpuscular haemoglobin MCHC: Mean corpuscular haemoglobin concentration

Table 4: Interaction effects of NLM, GM, NLM + GM and Inclusion levels on Haematological parameters of finishing broiler chickens

Additives	NLM				GM				NLM + GM				
	0	500	1000	1500	0	500	1000	1500	0	500	1000	1500	SEM
Inclusion levels (mg/kg)													
PCV (%)	28.00 ^b	29.50 ^b	30.50 ^b	29.50 ^b	28.00 ^b	27.50 ^b	26.00 ^b	45.50 ^a	28.00 ^b	35.50 ^{ab}	27.50 ^b	31.50 ^b	3.391
Hb (g/dl)	7.25 ^{bcd}	8.25 ^{abc}	7.90 ^{abc}	7.60 ^{abc}	7.25 ^{bc}	6.95 ^{bc}	6.25 ^c	10.50 ^a	7.25 ^{bc}	9.75 ^{ab}	7.80 ^{abc}	9.00 ^{abc}	0.881
RBC ($\times 10^{12}/l$)	1.75 ^{bc}	1.75 ^{bc}	2.30 ^{abc}	2.10 ^{bc}	1.75 ^{bc}	2.05 ^{bc}	1.70 ^{bc}	2.95 ^a	1.75 ^{bc}	2.45 ^{ab}	1.55 ^c	2.40 ^{ab}	0.238
WBC ($\times 10^9/l$)	10.80 ^{ab}	11.65 ^{ab}	11.10 ^{ab}	11.25 ^{ab}	10.80 ^{ab}	11.30 ^{ab}	10.15 ^b	11.35 ^{ab}	10.80 ^{ab}	12.65 ^a	11.05 ^{ab}	12.45 ^{ab}	0.689
HET (%)	30.00 ^{ab}	28.00 ^{ab}	28.50 ^{ab}	24.50 ^b	30.00 ^{ab}	32.00 ^{ab}	31.00 ^{ab}	24.00 ^b	30.00 ^{ab}	29.00 ^{ab}	22.50 ^b	36.00 ^a	2.869
LYM (%)	68.50 ^{abc}	71.50 ^{ab}	70.50 ^{abc}	73.00 ^{ab}	68.50 ^{abc}	67.50 ^{bc}	68.50 ^{abc}	74.00 ^{ab}	68.50 ^{abc}	70.50 ^{abc}	77.00 ^a	62.00 ^c	2.677
EOS (%)	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.50	0.50	0.50	0.00	0.50	0.354
BAS (%)	1.00	0.00	0.00	0.00	1.00	0.50	0.00	1.00	1.00	0.00	0.50	1.00	0.540
MONO (%)	1.00	0.50	1.00	1.50	1.00	0.00	0.50	0.50	1.00	0.00	0.00	0.50	0.661
MCV (fl)	159.80 ^{ab}	170.85 ^{ab}	132.30 ^b	141.05 ^b	159.80 ^{ab}	134.65 ^b	152.80 ^{ab}	153.56 ^{ab}	159.80 ^{ab}	145.10 ^{ab}	186.20 ^a	131.05 ^b	12.984
MCH (Pg)	41.30 ^{ab}	47.60 ^{ab}	33.95 ^b	36.20 ^{ab}	41.30 ^{ab}	33.60 ^b	36.70 ^{ab}	36.35 ^{ab}	41.30 ^{ab}	40.15 ^{ab}	53.95 ^a	37.45 ^{ab}	5.447
MCHC (g/dl)	25.85	27.90	25.60	25.70	25.85	25.05	24.05	23.70	25.85	27.55	28.40	28.55	1.800

^{abc} means on the same row having different superscript were significantly different (P<0.05)

^{abc} means on the same row having different superscript were significantly different (P<0.05)

GM= Garlic Meal NLM= Neem Leaf Meal GM= Garlic Meal NLM= Neem Leaf Meal PCV: Packed cell volume Hb: haemoglobin RBC: Red blood cell WBC: White blood cell HET: Heterophil LYM: Lymphocyte EOS: Eosinophil BAS: Basophil MONO: Monocyte MCV: Mean corpuscular volume MCH: Mean corpuscular haemoglobin MCHC: Mean corpuscular haemoglobin concentration

Table 5: Main effects of NLM, GM, NLM + GM and Levels of inclusion on Serum parameters of finishing broiler chickens
Additives

Parameters	NLM	GM	NLM + GM	SEM	Levels of inclusion (mg/kg)				SEM
					0	500	1000	1500	
Total protein (g/dl)	4.53	4.56	4.50	0.242	5.20 ^a	4.43 ^{ab}	4.60 ^{ab}	3.88 ^b	0.280
Albumin (g/dl)	2.61	2.75	2.71	0.177	3.30 ^a	2.60 ^b	2.67 ^b	2.20 ^b	0.204
Globulin (g/dl)	1.91	1.81	1.88	0.142	1.90	1.95	1.93	1.68	0.164
Glucose (mg/dl)	118.00	112.75	118.75	4.071	119.00	121.83	109.50	115.67	4.701
AST (u/l)	64.00	63.38	63.13	3.610	70.00 ^{ab}	72.33 ^a	58.33 ^b	53.33 ^c	4.168
ALT (u/l)	29.75	26.50	26.75	1.623	25.50	28.33	29.33	27.83	1.875
Urea (mg/dl)	2.08	2.11	2.13	0.257	2.40	1.77	2.13	2.12	0.285
Cholesterol (mg/dl)	96.88 ^{ab}	93.38 ^b	101.25 ^a	2.248	101.50 ^a	96.50 ^{ab}	98.00 ^{ab}	92.67 ^b	2.595
Triglyceride (mg/dl)	107.25	110.13	107.13	2.790	107.50	108.33	109.67	107.17	3.227
HDL (mg/dl)	59.71 ^{ab}	52.75 ^b	61.55 ^a	2.636	61.65	58.75	57.32	54.30	3.044
LDL (mg/dl)	17.09	18.60	18.28	0.887	18.35	17.92	18.75	16.93	1.025
VLDL (mg/dl)	21.45	22.03	21.43	0.559	21.50	21.67	21.93	21.43	0.645

^{abc} means on the same row having different superscript were significantly different (P<0.05)

GM= Garlic Meal NLM= Neem Leaf Meal GM= Garlic Meal NLM = Neem Leaf Meal AST: Aspartate transaminase ALT: Alanine transaminase HDL:

High density lipo-protein LDL: Low density lipo-protein VLDL: Very low density lipo-protein

Table 6: Interaction of NLM, GM, NLM + GM and Levels of inclusion on Serum parameters of finishing broiler chickens

Additives	NLM				GM				NLM + GM				SEM		
	I	Levels (mg/kg)	0	500	1000	1500	0	500	1000	1500	0	500		1000	1500
Total protein (g/dl)			5.25	5.25	5.00	5.05	5.00	5.10	5.70	4.80	4.95	5.05	5.30	5.05	0.475
Albumin (g/dl)			2.95	3.05	2.85	3.00	2.75	3.10	3.60	2.60	2.90	2.80	3.45	3.05	0.380
Globulin (g/dl)			2.30	2.20	2.15	2.05	2.25	2.00	2.10	2.20	2.05	2.25	1.85	2.00	0.240
Glucose (mg/dl)			119.00	133.00	114.50	116.00	117.00	109.00	119.00	112.00	118.00	126.00	112.50	127.50	7.198
AST (u/l)			49.50	53.50	55.50	47.50	48.50	68.00	64.00	61.50	51.50	65.50	69.00	56.50	9.658
ALT (u/l)			27.00 ^{ab}	24.50 ^{ab}	32.00 ^a	24.50 ^{ab}	27.00 ^{ab}	19.50 ^b	31.50 ^{ab}	28.00 ^{ab}	28.00 ^{ab}	25.50 ^{ab}	21.00 ^{ab}	26.50 ^{ab}	3.458
Urea (mg/dl)			2.25 ^{ab}	2.10 ^{ab}	2.05 ^{ab}	1.25 ^b	2.00 ^{ab}	1.90 ^{ab}	2.00 ^{ab}	2.25 ^{ab}	2.25 ^{ab}	2.30 ^{ab}	1.95 ^{ab}	2.95 ^a	0.387
Cholesterol (mg/dl)			105.00 ^{ab}	101.00 ^{ab}	99.00 ^{ab}	100.50 ^{ab}	105.00 ^{ab}	96.00 ^{ab}	116.00 ^a	110.00 ^{ab}	105.00 ^{ab}	107.00 ^{ab}	88.00 ^b	102.00 ^{ab}	6.815
Triglyceride (mg/dl)			104.00	108.00	117.00	111.50	104.00	110.00	107.00	107.00	104.00	114.000	105.50	108.50	3.849
HDL (mg/dl)			66.50	61.50	56.50	61.50	66.50	54.50	76.50	77.00	66.50	67.50	53.00	61.50	7.553
LDL (mg/dl)			17.70 ^{ab}	17.90 ^{ab}	19.10 ^a	16.70 ^{ab}	17.70 ^{ab}	19.70 ^a	18.10 ^{ab}	11.60 ^b	17.70 ^{ab}	16.70 ^{ab}	13.90 ^{ab}	18.80 ^a	1.942
VLDL (mg/dl)			20.80	21.60	23.40	22.30	20.80	22.00	21.40	21.40	20.80	22.80	21.10	21.70	0.770

^{ab} means on the same row having different superscript were significantly different (P<0.05)

GM= Garlic Meal NLM= Neem Leaf Meal GM= Garlic Meal NLM= Neem Leaf Meal AST: I.Llevels: Inclusion Levels. Aspartate transaminase AL.T: Alanine transaminase HDL: High density lipo-protein LDL: Low density lipo-protein VLDL: Very low density lipo-protein

not under stress due to dehydration or malnutrition (McDonald, 1996). The decrease in blood cholesterol and HDL in GM agreed with the result of Afsharmanesh *et al.* (2008) who reported that garlic decreased the blood cholesterol level and the HDL level was not raised. This could be due to effects of allicin in garlic which significantly inhibited hypercholesterolemia, reduced blood cholesterol and lowered low density lipoprotein concentration or bad cholesterol (Mirhadi *et al.*, 1992). Reduction in cholesterol at 1500ppm levels of inclusion agreed with the result of Al-Kassie and Ologhobo *et al.* (2008) who recorded big statistical differences in blood cholesterol level of treated birds compared to control birds respectively for garlic. However, the highest cholesterol content found in GM at 1000ppm inclusion agreed with the findings of Lee *et al.* (2004) who found no diminishing effect of garlic on birds. The decrease in LDL at 1500ppm inclusion of GM could be due to possible mechanism of antioxidant and anti-peroxide lowering action of GM (S-allyl cysteine sul-foxide) on LDL or the decrease in hepatic production of VLDL which serves as the precursor of LDL in the blood circulation (Kim *et al.*, 2009).

References

Afsharmanesh, M., Sadeghi Ronizi, B and Mehrabadi M. 2008. The Comparison of Natural Feed Additives (garlic and yogurt) with Antibiotic Growth Promoters on Broiler Performance; 1st National Conference Livestock and Poultry industry of Golestan province, Iran. 23-25.

Alder A and Holub B.J. 1997. Effect of garlic and fish-oil supplementation on serum lipid and lipoprotein

concentrations in hypercholesterolemic men," *American Journal of Clinical Nutrition*, (65), 445-450.

- Al-Kassie, G.A.M. and Jameel, Y.J. 2009. The effect of adding *Thyme vulgaris* and *Cinnamomum zeylanicum* on productive performance in broilers. Proceeding of 9th Veterinary Scientific Conference, College of Veterinary Medicine, University Baghdad, Iraq.
- Ameen, S. A., Adededeji, O. S., Akingbade, A. A., Olayemi, T. B., Oyedapo, L. O. and Aderinola, A. 2007. The effect of different feeding regimes on haematological parameters and immune status of commercial broilers in derived savannah zone of Nigeria. Proc. of 32nd Annual Conf. of NSAP, 18-21 March, Calabar, 146-148.
- Ayoola, M. O., Alabi, M. O., Sokunbi, O. A., Adewumi, A. A., Essien, A., Aderemi, F.A., Lawal, T. E. 2010. Physiological response of broiler starter chickens to oral supplementation with *Telfairia occidentalis* leaf extract. *Proceedings of the 35th Annual Conference of the Nigerian Society for Animal Production (NSAP)*, March, Ibadan, pp.126-128.
- Butaye, P., Devriese L.A. and Haesebrouk F. 2003. Antimicrobial growth Promoters used in animal feed: Effects of less well known antibiotics on gram Positive bacteria. *Clinical Microbial Reviews*, 16:175-188.
- Charis, K. 2000. A novel look at a classical approach of plant extracts. *Feed Mix* (special issue on *Nutraceuticals*), 19-21.
- Church, J.P., Judd J.T., Yomg C. W.,

- Kebay T.L. and Kim W.W. 1984. Relationship among dietary constituents and specific serum clinical components of subjects eating self-selecting diets. *America Journal Clinical Nutrition* 40: 1338-1344.
- Ciftci M, Guler T, Dalkıkcı B and Ertaş O.N. 2005. Effects of anise oil (*Pimpinella anisum* L.) on broiler performance. *International Journal of Poultry Science*. 11:851-855.
- Coles, E.H. 1986. Veterinary clinical pathology, 4th Ed. Coles, E. H. (ed), W.B. Saunder Company, Philadelphia, USA.
- Cross, D.E., Mcdevitt, R.M, Hillman, K, Acamovic, T 2007. The effects of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. *British Poultry Science* 48, 496-506.
- Davice, J.U. and Lewis S.M. 1991. Practical haematology, 8th Edition. Longman Ltd., London, U.K.,pp 22-28.
- Duncan, D.B., 2000. Multiple Range and Multiple F-test Biometric. 11: 1-24.
- Ganong, J. E. 1991. *A Review of Medical Physiology*. Lange Medical Publication. pp.115.
- Gardzielewska, J., Pudyszak K., Majewska T., Jakubowska M. and Pomianowski J. 2003.Effect of plant-supplemented feeding on fresh and frozen storage quality of broiler chicken meat. *Electronic Journal. Polish Agriculture University*.6: 12-12
- G o o g l e E a r t h . 2 0 1 2 . <http://www.google.earth>.
- Graczyk, S., Pliszcak-Krol, A., Kotonski, B., Wilczek, J. and Chmielak, Z. 2003. Examinations of haematological and metabolic changes mechanisms of acute stress in Turkeys. *Electronic Journal of Polish Agriculture University, Veterinary Medecine.*, 6: 1-10.
- Kim, HY, Shin H.S, Park H, Kim Y.C, Yun Y.G, Park S, Shin H.J, Kim K. 2008. *In vitro* inhibition of coronavirus replications by the traditionally used medicinal herbal extracts, Cimicifuga rhizoma, Meliae cortex, Coptidis rhizoma, and Phellodendron cortex. *Journal of clinical virology*.41:122-128.
- Lee K. W Everts H. Kappert H. J. van Der Kuilen J. Lemmens A. G. Frehner M. Beynen A. C. 2004b. Growth performance, intestinal viscosity, fat digestibility and plasma cholesterol in broiler chickens fed a rye-containing diet without or with essential oil components. *International Journal of Poultry Science.*; 3:613-618.
- Mansoub, N.H. 2010. Comparison of effects of using Nettle (*Urtica dioica*) and probiotic on performance and serum composition of broiler chickens. *Global Veterinaria*, 8: 247-250
- McDonald, S. 1996. Complete blood count. *Avian quarterly*. <http://www.parrottalk.com/cbc.html>. Retrieved 29/11/2009.
- Mirhadi S A, Singh S, Gupta P P. 1992. Effect of garlic supplementation to cholesterol-rich diet on development of atherosclerosis in rabbits. *Industrial Journal of Experimental Biology* 29:162-168.
- Mitruka, B. M. and Rawnsley, H. 1977. Clinical biochemistry and hematological reference values innormal experimental Animals. 1st edition, Masson Publishing Inc. New

York, USA. pp.54-55.

Odunsi, A.A., Ogunleke, M.O., Alagbe, O.S. and Ajani, T.O. 2002. Effect of feeding *Gliricidia sepium* leaf meal on the performance and egg quality of sheabutter cake or palm kernel cake in the humid tropics. *J. Applied. Anim. Res.* 10:173-180.

Olorede, .B.R., Onifade, A.A., Okpara, A.O and Babatunde, G.M. 1996. Growth, nutrient retention, haematology and serum chemistry of broiler chickens fed sheabutter cake or palm kernel cake in the humid tropics. *J. Applied. Anim. Res.* 10:173-180

Rahmatnejad. E and Roshanfekar H. 2009. Evaluation of the effect of several non-antibiotic additives on growth performance of broiler chickens *Journal of Animal and Veterinary Advances* 8(9):1757-1760

Rajurker, S., Rekhe, D. S., Maini, S. and Ravikanth, K. 2009. Acute toxicity studies of polyherbal formulation (Methiorep® premix). *Veterinary World.* 12(2):58-59.

Reuter, H.D., Koch H.P. and Lawson L.D. 1996. Therapeutic Effects and Applications of Garlic and its

Preparations. In: *Garlic: The Science and Therapeutic Application of Allium sativum L. and Related Species*, Koch, H.P. and L.D. Lawson (Eds.).

Williams and Wilkins, Baltimore, MD., pp:135-213.

Subapriya, R. and Nagini S. 2005. Medicinal properties of neem leaves: A review, *Current Medical Chemistry. Anti-cancer Agents.* 5(2):149-6.

Tekeli, A., Celik, L, Kutlu H.R. and Gorgulu, M. 2006. Effect of dietary supplemental plant extracts on performance, carcass characteristics, digestive system development, intestinal microflora and some blood parameters of broiler chicks; XII European Poultry Conference, Italy, 10–14. Sept 20

Vecerek, V., Strakova, E., Suchy, P. and Voslarova, E. 2002. Influence of high environmental temperature on production and haematological and biochemical indices of broiler chickens. *Czech Journal. Animal, Science.,* 47:176-182.