

EFFECT OF REPLACING MAIZE WITH DOUM PALM PULP MEAL ON THE GROWTH PERFORMANCE AND SOME HAEMATOLOGICAL PARAMETERS OF BROILERS

Aliyu, Bako*, Audu, Abubakar, Mohammed, Sule

Department of Animal Science, Kano State University of Science and Technology, Wudil, Kano State, Nigeria.

Corresponding author: Aliyu, Bako, Email: draliyubako001@gmail.com

Abstract: This 6 weeks experiment was carried out to evaluate the effect of replacing doum palm pulp meal on the growth performance and haematological parameters of broilers. A total of 350 1-day old broiler chicks (Arbo acres) were randomly distributed into five treatments with seven replicates, each of the replicates consist of ten birds each and a completely randomized design was adopted. Experimental diet was formulated to meet all the nutrient requirements for broilers according to NRC (1994) recommendation. Diet 1 was a control diet without doum palm pulp meal while doum palm pulp meal was used to replace maize at 5%, 10 %, 15 % and 20 % in diet 2, 3, 4 and 5 respectively. Birds had unlimited access to feed and clean water throughout the 42 days experimental period. Proximate analysis of doum palm pulp meal showed that it contained crude protein (7.91 %), crude fibre (13.41 %), ether extract (0.75 %), ash (9.88 %) and metabolizable energy (3440.8 Kcal/kg). Average weight gain (1971.2 - 1958.9 g), total feed intake (4892.1 - 4920.1 g) and feed conversion ratio (2.41 - 2.44) were not significantly different except for mortality rate ($p < 0.05$). Total erythrocyte count, haemoglobin, hematocrit and total leucocyte count were significantly ($p < 0.05$) different among the treatments. However, values were within the standard reference range for healthy birds. It was concluded that doum palm pulp meal can be used to replace maize up to 20 % without compromising the performance of broilers.

Keywords: Doum palm; Maize; Performance; Haematology; Replacement

1 INTRODUCTION

Feeding costs are the most significant expenses in animal production including poultry production, and forms 70 % of the total cost of animal production [1]. Feed formulated should be cost effective, considering the cost of ingredients as well as their digestibility efficiencies to meet nutritional requirement of the animal [2]. The rapid increase in human population has necessitated a corresponding increase in animal products to provide adequate quantities of animal protein. Shortage of feed stuff is one of the major limiting factors for increasing animal production [3]. Efforts are been made by nutritionist to employ the use of unconventional feedstuffs to reduce the pressure on maize. Among the potential alternative is the use of doum palm pulp meal.

Doum palm (*Hyphaene thebaica*) is a desert palm tree with edible oval fruit belonging to the family Arecaceae [4,5]. The plant is dichotomous and arborescent in nature and has been listed as one of the useful plants of the world [6]. The tree can grow up to 6 or 9 m in height and usually has forked stems with fan shaped leaves of about 65–75 cm long [7]. Doum palm kernel is edible when it is unripe but hard when it is ripe and its palm can be used for local craft [7]. The foliage is used to make mats, ropes, baskets, and hats while the stem with the leaves are used for construction purpose [8]. The pulp and seeds have been reported to contain some medicinal properties (anti-inflammatory, antioxidant, antifungal, hepato-protective, immune-stimulatory, antimicrobial amongst others) due to the presence of tannins, alkaloids, flavonoids, glycosides, saponins and phenols [9,10].

According to Nwosu et al., [32]; Alagbe [1], the pulp of doum palm have been reported to contain minerals including, potassium (3366.21 mg/100g), calcium (292.04 mg/100g), sodium (212.27 mg/100g), magnesium (177.14 mg/100g), iron (4.86 mg/100g), manganese (0.83 mg/100g), zinc (0.68 mg/100g), copper (0.40 mg/100g), nickel (0.32 mg/100g) and cobalt (0.12 mg/100g). They are also excellent source of vitamin B-complex. The aqueous extract of leaves, root and stem bark of doum palm has revealed an antifungal activity against a wide range of fungal isolates. Also, prominent antibacterial activities of doum fruits were reported against gram positive and gram negative bacteria [5,33].

Previous studies has shown that maize can be replaced with doum palm pulp meal at 20 % in the diet of rabbits [3,9]. Abdulsalam et al. [10]; John also recorded a significant difference in final body weight of broilers when maize was replaced with doum palm pulp meal at 10 % [2]. Further studies in replacing maize with doum palm pulp meal will help to reduce the pressure on conventional feedstuffs and improve productivity.

Therefore, the aim of this study was to investigate the effect of replacing maize with doum palm pulp meal on the growth performance and some haematological parameters of broilers

2 MATERIALS AND METHODS

2.1 Experimental Location

The experiment was conducted at the department of Animal Science, Kano State University of Science and Technology, Wudil, Kano State, Nigeria.

2.2 Collection and Processing of Doum Palm Pulp Meal

Mature doum palm fruit was purchased from an open market in Rano local government area, Kano State and sent immediately to the department of biological science for proper identification, sample was assigned number (SD/008/2024). Thereafter, the kernel was separated from the pulp using a crusher. Collected pulp were air dried for 2 days before it was grinded into meal with an hammer mill before it was packed into labelled containers.

2.3 Management of Experimental Animal and Design

350 – 1-day old broiler chick (Arbo Acre) mixed sex with an average initial body weight of g randomly distributed to five treatments with seven replicates consisting of 10 birds each. Birds were reared in a battery cages measuring 4ft by 2.5 ft (length × width) equipped with nipple drinkers and manual feeders kept in pen. All experimental diet was adequate in all nutrient was formulated according to NRC guidelines for broilers[11]. A completely randomized experimental design was adopted throughout the 6 weeks experimental period. Birds had unrestricted access to clean water and feed.

2.4 Experimental Set -up

Birds in treatment 1 were fed diet without doum palm pulp meal
 Treatment 2: doum palm pulp meal was used to replace maize at 5 %
 Treatment 3: doum palm pulp meal was used to replace maize at 10 %
 Treatment 4: doum palm pulp meal was used to replace maize at 15 %
 Treatment 5: doum palm pulp meal was used to replace maize at 20 %

3 GROWTH PARAMETERS

Feed intake: This was calculated each day by taking the entire amount of feed delivered to the birds less the total amount left over.

Weight gain: This was computed by determining the difference between the initial body weight and final body weight.

Feed Conversion Ratio (FCR): This was determined as the ratio between feed intake and weight gain.

$$FCR = \frac{\text{Total feed intake}}{\text{Total weight gain}} \quad (1)$$

4 BLOOD COLLECTION AND ANALYSIS

At the end of the experiment, seven birds were randomly selected from each treatment for haematological studies. 2 mL of blood was collected through the wing vein of birds into a sterile sample bottle with anticoagulant. After each collection, blood was placed in an ice pack before it was transferred to the laboratory for further evaluation. Parameters examined includes, total erythrocytes count, hemoglobin, haematocrit count and total leucocyte count. Analysis was carried out using Geyser automated haematological analyzer (Model WD/12EE/008, China).

4.1 Proximate Analysis of Experimental Diet

Proximate analysis of experimental diet was carried out using methods described by Association of Analytical Chemist [12].

4.2 Analysis of Data

All the data collected were subjected to one-way ANOVA using Statistical Package for Social Sciences (version 21). The differences among the treatment means were determined ($P < 0.05$) by Duncan multiple range test of the same statistical package.

5 RESULT AND DISCUSSION

As shown in Table 1, proximate analysis of doum palm meal contained crude protein (7.91 %), crude fibre (13.41 %), ether extract (1.75 %), ash (9.88 %) and metabolizable energy (3440.8 Kcal/kg). Result obtained in this study is in agreement with the reports of Alagbe and Anuore [9], who recorded a crude protein of 7.89 %, crude fibre (13.42 %), ether extract

(0.76 %), ash (10.10 %) and energy (3443.7 Kcal/kg) but higher than those reported by Waleed et al. [5] who reported a crude protein (2.40 %), ash (4.00 %), ether extract (0.39 %) and energy (3200.3 Kcal/kg). Bonde et al. [6] also recorded a crude protein (5.33 %), ether extract (0.21 %), ash (4.04 %) and energy (3005.6 Kcal/kg). The discrepancies in the outcome of their results can be attributed to age of plant, species, geographical location, processing technique amongst others [13,14]. Result on crude protein recorded in this study is less than 30 % which makes doum palm meal unsuitable as a good protein supplement in the diet of non-ruminant animals [16,17].

Table 1 Proximate Analysis of Doum Palm Meal

Parameters	Concentration
Crude protein (%)	7.91
Crude fibre (%)	13.41
Ether extract (%)	0.75
Ash (%)	9.88
Energy (Kcal/kg)	3440.8

Table 2 Ingredient and Chemical Composition of Experimental Diet (Starter feed: 0 - 3 weeks)

Ingredients	Diet 1 (0 %)	Diet 2 (5 %)	Diet 3 (10 %)	Diet 4 (15 %)	Diet 5 (20 %)
Maize	54.00	51.30	48.60	45.90	43.20
Doum palm	-	2.70	5.40	8.10	10.80
Wheat bran	4.00	4.00	4.00	4.00	4.00
Groundnut cake	10.00	10.00	10.00	10.00	10.00
Soya cake	25.00	25.00	25.00	25.00	25.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.50	1.50	1.50	1.50	1.50
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Vit TM Premix	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.20	0.20	0.20	0.20	0.20
Toxin binder	0.50	0.50	0.50	0.50	0.50
Total	100.0	100.0	100.0	100.0	100.0
Calc. Analyses					
%CP	23.09	23.06	23.03	23.01	22.98
ME:Kcal/kg	2989	2979	2969	2959	2950
EE %	4.59	4.53	4.48	4.42	4.37
CF %	4.32	4.36	4.39	4.42	4.45
Ca %	1.50	1.50	1.50	1.50	1.50
Avail P %	0.57	0.57	0.57	0.57	0.57
Lysine %	1.35	1.35	1.35	1.35	1.35
Met + cys (%)	0.89	0.89	0.89	0.89	0.90

Mineral-vitamin premix, Each 2.5 kg sachets contains; Thiamine, 10,000 mg, riboflavin, 12,000 mg, pyridoxine, 5000 mg, cyanocobalamine, 5000 mg, niacin, 20,000 mg, D-panthotenate, 10,000 mg, folic acid, 500 mg, biotin, 2000 mg, cholecalciferol, 3,000,000 iu., tocopherol acetate, 25,000 iu., ascorbic acid, 62,000 mg, manganese, 56mg, iron, 70,200 mg, 300 mg, iodine, 200 mg, selenium, 85 mg, choline chloride, 46,000 mg

Table 3 Ingredient and Chemical Composition of Experimental Diet (Finisher feed: 4 - 6 weeks)

Ingredients	Diet 1 (0 %)	Diet 2 (5 %)	Diet 3 (10 %)	Diet 4 (15 %)	Diet 5 (20 %)
Maize	57.00	54.15	51.30	48.45	45.60
Doum palm	-	2.85	5.7	8.55	11.4
Wheat Offal	4.00	4.00	4.00	4.00	4.00
G/Cake 44%	10.0	10.0	10.0	10.0	10.0
Soya cake	20.0	20.0	20.0	20.0	20.0
Fish meal	1.50	1.50	1.50	1.50	1.50
Limestone	2.00	2.00	2.00	2.00	2.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Salt	0.30	0.30	0.30	0.30	0.30
Vit TM Premix	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.20	0.20	0.20	0.20	0.20
Toxin binder	0.50	0.50	0.50	0.50	0.50
Total	100.0	100.0	100.0	100.0	100.0
Calc. Analyses					
%CP	21.25	21.22	21.20	21.17	20.94
ME:Kcal/kg	3166	3155	3145	3135	3125
EE %	4.37	4.31	4.25	4.19	4.13
CF %	3.97	4.01	4.04	4.08	4.11
Ca %	1.93	1.93	1.93	1.93	1.93
Avail P %	0.70	0.70	0.69	0.69	0.69
Lysine %	1.21	1.21	1.21	1.21	1.21
Met + cys (%)	0.84	0.84	0.84	0.84	0.84

Mineral-vitamin premix, Each 2.5 kg sachets contains; Thiamine, 8000 mg, riboflavin, 12,000 mg, pyridoxine, 5000 mg, cyanocobalamine, 5000 mg, niacin, 20,000 mg, D-panthotenate, 10,000 mg, folic acid, 500 mg, biotin, 2000 mg, cholecalciferol, 3,000,000 iu., tocopherol acetate, 25,000 iu., ascorbic acid, 62,000 mg, manganese, 56mg, iron, 70,200 mg, 300 mg, iodine, 200 mg, selenium, 85 mg, choline chloride, 46,000 mg.

As presented in Table 4, effect of replacing maize with doum palm meal on the growth performance of broiler chickens. The average final weight values varied from 2010.0 - 2023.1 g, average total feed consumed (4892.1 - 4920.1 g) and feed conversion ratio (2.41 - 2.44). All these parameters were not influenced ($p>0.05$) by the treatment. Average final weight recorded in this study was similar 2007.8 - 2200.6 g reported by Alagbe et al. [17] when melon - groundnut shell mixture was used to replace maize in birds but lower than (1550.1 - 1662.6 g) reported by Tornekar et al. [18] when bajra was used to replace maize in broilers. This result suggests that the experimental diet was rich in nutrients capable of modulating the growth of birds. Though total feed consumption increases slightly as the level of doum palm meal increased though not at a significant ($p>0.05$) level. The result indicates that dietary replacement of maize with doum palm meal improves the palatability of the feed due to the presence of phyto-components in them. According to John [19]; John [20], phyto-components contain essential nutrients and possess medicinal properties such as anti-inflammatory, antioxidant, antifungal, anti-helminthic, hepato-protective, immune-stimulatory amongst others. Total feed consumption recorded in this experiment was similar (4200 - 5006.1 g) reported by Ibe et al. [21]; Alagbe who examined the performance characteristics of broiler chicks fed graded levels of white guinea corn as a replacement for maize [17]. Feed conversion ratio obtained was in agreement with the findings of Jayanaik et al. [22]. Mortality was recorded only among birds fed doum palm meal suggesting that it possesses phyto-components with antimicrobial properties capable of inhibiting the activities of pathogenic organisms in the intestinal flora [23,24].

Table 4 Effect of Replacing Maize with Doum Palm Meal on the Growth Performance of Broiler Chickens

Variables	Diet 1 (0 %)	Diet 2 (5 %)	Diet 3 (10 %)	Diet 4 (15 %)	Diet 5 (20 %)	SEM
Number of birds	70	70	70	70	70	-
Average initial body weight (g/b)	51.81	51.24	51.11	51.07	51.02	0.01
Average final body weight (g/b)	2023.1	2019.5	2012.7	2010.4	2010	21.40
Average weight gain (g/b)	1971.2	1968.2	1961.5	1959.3	1958.9	18.77
Average total feed consumed (g/b)	4892.1	4900.3	4911.2	4919.3	4920.1	45.06
Feed conversion ratio	2.41	2.42	2.44	2.44	2.44	0.01
Mortality (%)	2.16 ^a	0 ^b	0 ^b	0 ^b	0	0.01

Means in the same row with different superscript letters are significantly different ($p < 0.05$); diet 1: control (without doum palm pulp meal); diet 2: maize replaced with 5 % doum palm pulp meal; diet 3: maize replaced with 10 % doum palm pulp meal; diet 4: maize replaced with 15 % doum palm pulp meal; diet 5: maize replaced with 20 % doum palm pulp meal; SEM: standard error of mean.

As presented in Table 5, effect of replacing maize with doum palm meal on the haematological indices of broiler chickens. Hematocrit values which ranged from 28.81 - 34.20 %, total erythrocyte count [(2.62 - 3.52 ($\times 10^{12}/L$))], total leucocytes [(11.84 - 20.96 ($\times 10^9/L$))] and hemoglobin (8.89 - 13.57 g/dL) were significantly ($p < 0.05$) by the treatment. Values were higher in doum palm meal group relative to the control. Hematocrit, hemoglobin and total erythrocyte count were within the range 25.00 - 36.00 %, 7.11 - 15.00 g/dL and 2.00 - 11.00 ($\times 10^{12}/L$) cited by Caf e et al. [25]; Bounous and Stedman [26]; Brown and Clime [27]. This suggest suggests the absence of anaemia or vitamin deficiency in the blood [28]. Higher erythrocyte count is a sign of sufficient oxygen in the system of birds [29]. Leucocyte count obtained in this study was within the values [(10.09 - 25.00 ($\times 10^9/L$))] cited by Jain [30]. Leucocytes are responsible for the production of antibodies to fight against infections in the body of animals [31].

Table 5 Effect of Replacing Maize with Doum Palm Meal on the Haematological Indices of Broiler Chickens

Variables	Diet 1 (0 %)	Diet 2 (5 %)	Diet 3 (10 %)	Diet 4 (15 %)	Diet 5 (20 %)	SEM
Hematocrit (%)	28.81 ^b	34.05 ^a	34.11 ^a	34.18 ^a	34.20 ^a	0.13
Total erythrocytes ($\times 10^{12}/L$)	2.62 ^b	3.41 ^a	3.80 ^a	3.96 ^a	4.52 ^a	0.01
Total leucocytes ($\times 10^9/L$)	11.84 ^b	19.92 ^a	20.40 ^a	20.87 ^a	20.96 ^a	0.10
Haemoglobin (g/dL)	8.89 ^b	12.67 ^a	13.05 ^a	13.46 ^a	13.57 ^a	0.06

Means in the same row with different superscript letters are significantly different ($p < 0.05$); diet 1: control (without doum palm pulp meal); diet 2: maize replaced with 5 % doum palm pulp meal; diet 3: maize replaced with 10 % doum palm pulp meal; diet 4: maize replaced with 15 % doum palm pulp meal; diet 5: maize replaced with 20 % doum palm pulp meal; SEM: standard error of mean.

6 CONCLUSION

It was concluded that doum palm meal has a lot of nutritional and medicinal potentials. Replacing maize up to 20 % with doum palm pulp meal did not pose any negative effect on the growth of broilers. The blood parameters were influenced. However, these values were within the standard range for healthy birds. Further research needs to be carried out by increasing the replacement of maize above 20 %.

CONFLICT OF INTEREST

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

- [1] Alagbe, JO. Effect of different levels of feed added Coriander (*Coriandrum sativum*) leaves meal on the performance, carcass quality, immune response and blood profile of quails (*Corturnix cortunix japonica*). Pacific International Journal, 2018, 1(3): 40-53.
- [2] John, AO. Effect of performance, serum biochemistry and heamatological components of feeding Japanese quails phytogenic feed additions comparing Megaphrynium macrostachyum leaves. Brazilian Journal of Science, 2024, 3(5): 51-64.
- [3] Alagbe, JO, Omokore, EA, Tijani, TD. Effect of dietary supplementation of dried Spondias mombin Linn leaf on the performance and blood profile of broiler chickens. Pacific International Journal, 2018, 2(2): 46-58.
- [4] Hoebeke, P. The doum palm (*Hyphaene compressa*) as biological resource in Turkana District, Kenya. M.Sc. thesis,

- University of Trondheim, Norway. 1989.
- [5] Waleed Aboshora, Zhang L, Mohammed, D, et al. Physicochemical, Nutritional and Functional Properties of the Epicarp, Flesh and Pitted Sample of Doum Fruit (*Hyphaene Thebaica*). *Journal of Food and Nutrition Research*, 2014, 2(4): 180-186. DOI: 10.12691/jfnr-2-4-8.
- [6] Bonde, SD, Agate, VV, Kulkarni, DK. Nutritional composition of the fruits of doum palms (*Hyphaene*) from the west coast of India. *Principes*, 1990, 34(1): 21-23
- [7] Faten, MAE. Antioxidant and anticancer activities of doum fruit extract (*Hyphaene thebaica*). *African Journal of Pure and Applied Chemistry*, 2009, 3(10): 197-201.
- [8] Dosurnu, OO, Nwosu, FO, Nwogu, CD. Antimicrobial studies and Phtochemical Screening of extracts of *Hyphaene thebaica* (Linn) Mart fruits. *International Journal of Tropical Medicine*, 2006, 1(4): 186-189.
- [9] Alagbe Olujimi John, Anuore, Daniel Nnadozie. Effect of Doum palm mesocarp meal (*Hyphaene thebaica*) as partial replacement for maize on growth performance and heamatological indices of weaned pigs. *Journal of Biotechnology and Bioinformatics Research*, 2023, 5(3): 1-6.
- [10] Abdulsalam I, Magaji MY, Bah SU. Effects of Dietary Levels of Doum Palm Pulp Meal (*Hyphaene thebaica*) Supplementation on the Performance of Broiler Chickens. *Asian Journal of Research in Animal and Veterinary Sciences*, 2018, 2(2): 1-8.
- [11] NRC. Nutrient requirements of poultry. National Academy Press, Washington D.C. USA. 1994.
- [12] Association of Official Analytical Chemists International. Official Methods of Analysis of the Association of Official Analytical Chemists International 17th edn.. Association of Official Analytical Chemists International, Arlington, VA, USA. 2000.
- [13] Alagbe, J.O. Proximate, mineral and phytochemical analysis of some medicinal plants collected from Orathur village, Thiruporur Taluk Kancheepuram district Tamilnadu, India. *World Journal of Agriculture and Forestry Sciences*, 2024, 2(2): 30-35.
- [14] Alagbe, JO, Muritala, SD, Aduragbemi, YA, et al. The approximate mineral and phytochemical content of the leaves, stem bark and roots of *Pterocarpus erinaceus* in India. *Cerrado: Agricultural and Biological Research*, 2024, 1(1): 32-41.
- [15] Alagbe, JO, Adeoye, Adekemi, Oluwatobi, OA. Proximate and mineral analysis of *Delonix regia* leaves and roots. *International Journal on Integrated Education*, 2020, 3(10): 144-149.
- [16] Alagbe, JO, Sharma, R, Eunice Abidemi Ojo, et al. Chemical evaluation of the proximate, minerals, vitamins and phytochemical analysis of *Daniellia oliveri* stem bark. *International Journal of Biological, Physical and Chemical Studies*, 2020, 2(1): 16-22.
- [17] Alagbe, JO. Effect of dietary supplementation of date palm (*Phoenix dactylifera*) seed powder on the performance and carcass characteristics of weaned rabbits. *International Journal of Applied and Science Research*, 2024, 2(9): 767-778.
- [18] Tornekar, AP, Munde, VK, Kokan, SS. Effect of Replacing Maize with Bajra (Pearl Millet) on the Performance of Broilers. *Veterinary World*, 2009, 2(8): 310-312.
- [19] John, AO. Growth performance, haemato-biochemical indices of broiler chicken fed *Aristolochia indica* as a phytogetic feed additive. *Cerrado: Agricultural and Biological Research*, 2024, 1(1): 42-53.
- [20] John, AO. *Clerodendron splendens* leaf extract supplementation in weaner rabbits: impact on growth performance, haematology and intestinal microbial population. *Cerrado: Agricultural and Biological Research*, 2024, 1(1): 21-31.
- [21] Ibe, EA, Bulus, ED, Ogundipe, SO, et al. Performance characteristics of broiler chicks fed graded levels of white guinea corn as a replacement for maize. *Continental J. Animal and Veterinary Research*, 2013, 5(1): 15-41.
- [22] Jayanaik, UB, Venkatarreddy, K, Murthy, NN, et al. Effect of replacement of finger millet (*Eleusine coracana*) and sorghum (enzymes in broiler diets on dry matter metabolizable energy and performance of broilers. *Agric. Science*, 2008, 42(3): 502-509
- [23] John, AO. Effect of coconut shell extract on the growth performance and some haemato-biochemical parameters of broiler chicken. *Brazilian Journal of Science*, 2024, 3(6): 82-95.
- [24] John, AO. Impact of dietary supplementation of *Rhamnus prinoides* leaf extract on the growth performance, nutrient retention and intestinal microbial count of Japanese quails. *Brazilian Journal of Science*, 2024, 3(5): 40-50.
- [25] Café, MB, Rinaldi, FP, Morais, HR, et al. (2012). Biochemical blood parameters of broilers at different ages under thermoneutral environment. *World Poultry Conference, Salvador-Bahia-Brazil*, 2012.
- [26] Bounous, DL, Stedman, NL. Normal Avian Haematology: Chicken and Turkey. In Feldman, BF, Zinkl, JG, Jain, NC, Lippin Cotts, Williams, Wilkisin, Philadelphia, 2000, 1147-1154.
- [27] Brown, JA, Clime, TR. Nutrition and Haematological values. *Journal of Animal Science*, 1972, 35, 211-218.
- [28] Alagbe, JO. Performance and haemato-biochemical parameters of weaner rabbits fed diets supplemented with dried water melon (rind) meal. *Journal of Dairy and Veterinary Sciences*, 2019, 8(4): 001-007.
- [29] Jain, NC. *Essentials of Veterinary Haematology*, 4th Edition. Lea and Febiger, Philadelphia, U.S.A. 1993.
- [30] Jain, NC. *Schalm's Veterinary Haematology*. 4th Edition, Lea and Febiger, Philadelphia. 1986.
- [31] Islam, MS, Lucky, NS, Islam, MR, et al. Haematological parameters of Fayoumi, Assil and local chickens reared in Sylhet Region in Bangladesh. *International Journal of Poultry Science*, 2004, 4(10): 748-756.

- [32] Nwosu, FO, Dosumu, OO, Okocha, JOC. The potential of Terminalia catappa (Almond) and Hyphaene thebaica (Dum palm) fruits as raw materials for livestock feed. African Journal of Biotechnology, 2008, 7(24): 4576-4580.
- [33] Hsu, B, Coupar, IM, Ng, K. Antioxidant activity of hot water extracts from the fruit of the Doum palm, (Hyphaene thebaica) Food Chemistry, 2006, 98(2): 317-328.