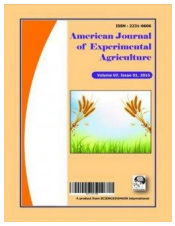

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Haematology and Carcass Visual Appraisal of Broiler Chickens fed Supplemental Diets of *Aspilia africana*, *Azadirachta indica* and *Centrosema pubescence* Leaf Meals in Humid Tropical Nigeria

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Authors' contributions

This work was carried out in collaboration between all the authors. Author BBO collected and carried out the laboratory analysis of the blood samples. Author GAK designed the study, wrote the protocol and wrote the first draft of the manuscript. Author HAM supervised and thoroughly proof read the manuscript. Author ONW reviewed the experimental design and performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

A study to determine the haematology and carcass visual appraisal of broiler chickens fed basal feeds supplemented with different leaf meals was conducted. Four treatments: Basal proprietary broiler feed only (T_1 - PBF) as control, basal proprietary broiler feeds with *Centrosema pubescence* (T_2 - PBF + CLM), *Azadirachta indica* (T_3 - PBF + NLM) and *Aspilia africana* (T_2 - PBF + ASLM) respectively, were used in a completely randomized design (CRD). On the last day of a 63-day feeding and growth trial, a set of 2 ml blood samples were taken from 3 broilers per treatment into plastic tubes containing the anti-coagulant ethylene diamine tetraacetic acid (EDTA) for the determination of haematological parameters: PCV, Hb, RBC and WBC. The MCHC, MCH and MCV were also determined. Visual appraisals of their external body parts per treatment were also carried out. Results on the blood parameters of broilers fed *Aspilia africana*, *Azadirachta indica* and

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Centrosema pubescence leaf meals showed normal blood values recommended for healthy birds. Similarly, broilers fed these leaf meals showed a better appeal for their carcasses because of the yellow pigmentation of their body parts (shank, skin, beak and ear lobes). This will be an advantage to the consumers because it supplies vitamin A necessary for better vision. It was concluded that poultry farmers incorporate *Aspilia africana*, *Azadirachta indica* and *Centrosema pubescence* at 5% inclusion levels in broiler feeds because it is not deleterious and can be of additional advantage due to the attractiveness of their carcasses to consumers.

Keywords: Broilers; leaf meals; haematology; carcass body parts; visual appraisal.

1. INTRODUCTION

The feed crisis facing the poultry industry in Nigeria strongly suggests the need to investigate and utilize cheap and easily obtainable non-conventional feed resources. One of such non-conventional feed resources is leaf meal. The incorporation of protein from leaf sources in diets for broilers is fast gaining grounds because of its availability, abundance and relatively reduced cost. It had earlier been observed that leaf meal do not only serve as protein sources but also provide some necessary vitamins, minerals and also oxy-carotenoids which causes yellow colour of broiler skin, shank and egg yolk [1].

Many feed materials are fed to animals usually without recourse to their health and physiological implications on the animals. The commonest method for measuring these implications is through the haematology of the animals [2]. There has been the emphasis that nutritional studies should not be limited to performance and carcass quality alone, but its effect on blood constituent is also very relevant [3]. Therefore, the comparison of an animal's haematological and biochemical values with a reference interval will provide evidence for numerous conditions such as infection, malnutrition and stress [4]. Similarly, laboratory tests on blood have been revealed as very vital tools to detect any deviation from the normal in the animal or human body [5]. Furthermore, with the growing knowledge of the quality of animal protein supplies in human diets, and the preference for carcasses of good visual appraisal, it becomes imperative for poultry feed manufacturers and farmers to source tangible alternatives to cope with the current challenges in the meat market.

Plant leaves such as *Aspilia africana*, *Azadirachta indica* (Neem) and *Centrosema pubescence* abound within the humid tropical environment of the South-south geopolitical zone of Nigeria and has not been maximally utilized as leaf meal supplements in poultry feeds. However, investigations on the use of the leaves especially *Aspilia africana* and *Azadirachta indica* (Neem) has been on their utilization as traditional medicines in maintaining the health and welfare of both rural and urban dwellers in developing countries [6,7]. There is therefore the need to investigate the effects of predominant plant materials: *Aspilia africana*, *Azadirachta indica* (Neem) and *Centrosema pubescence* as leaf meal supplements on the haematology and carcass appearance of broiler chickens in the area.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was conducted at the poultry unit of the Teaching and Research Farm, Ignatius Ajuru University of Education Ndele Campus, Rivers State (Latitude 4º58' N and Longitude 6º 48' E), Nigeria.

2.2 Processing of Test Ingredients

Fresh leaves from the young stems of the test ingredients: *Centrosema pubescence*, *Aspilia africana* and *Azadirachta indica* (Neem) were manually harvested from the bush and fallow sections within the premises of the Ignatius Ajuru University of Education at Ndele Campus. The fresh leaves were collected in batches in labeled bags. The leaves together with their stems were spread on black polythene on an open floor in a greenhouse and air dried for seven (7) days until it became crispy and shredded to separate the leaves from the stems. Air drying of the leaves was carried out to reduce moisture content, to prevent fungal growth and easy milling of the materials. The milling was done with a hand grinding machine. The milled products represent the test materials which were incorporated differently in the proprietary basal concentrate feeds.

2.3 Birds and Distribution to Treatment Groups

A total of one hundred and eighty (180) day old of Marshal strain of broiler chicks were brooded in the brooding unit (deep litter system) for 4 weeks (28 days) using stove and kerosene lanterns. The chicks were randomly allotted to four (4) dietary feed treatment groups: basal proprietary broiler feed only (T_1 - PBF) as control, basal proprietary broiler feeds supplemented with *Centrosema pubescence* (T_2 - PBF + CLM), *Azadirachta indica* (Neem) (T_3 - PBF + NLM) and *Aspilia africana* (T_4 - PBF + ASLM). The respective leaf meals were incorporated at 5% supplemental levels into the basal proprietary broiler feeds.

2.4 Determination of Haematological Parameters

On the last day of a 63-day (9 weeks) experimental feeding and growth trial, a set of blood samples were taken from 3 birds per dietary treatment randomly. The blood samples were collected by carefully cutting the jugular veins of each birds and collecting 2 ml samples of blood into plastic tubes containing the anti-coagulant ethylene diamine tetraacetic acid (EDTA) for the determination of haematological parameters.

The Haematological values of the blood samples were estimated for packed cell volume (PCV) and haemoglobin (Hb) concentration. Red blood cell (RBC) and total white blood cell (WBC) as well as the differential WBC counts were determined using the Neubauer haemocytometer after appropriate dilution. Values for the constants: mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) were calculated from RBC, Hb and PCV values.

2.5 Visual Appraisal on Pigmentation of External Body Parts

At the end of the experiment after 63-days (9 weeks), the broilers from the leaf meal treatment groups (T_2, T_3 and T_4) and control (T_1 – without leaf meal treatment) were also physically assessed based on the yellowish pigmentation of the skin, beak, earlobe and shank.

2.6 Statistical Analysis

The haematological data obtained from birds in each treatment group were compared statistically on the basis of the different dietary treatments using Analysis of Variance (ANOVA) procedure for a Completely Randomized Design (CRD) [4]. Significant means were separated using the Duncan's New Multiple Range Test [8].

3. RESULTS AND DISCUSSION

3.1 Nutrient Composition of Leaf Meals and Basal Concentrate Broiler Finisher Feeds

The nutrient composition of the different leaf meals, the proprietary broiler feed (finisher) and those supplemented with the different leaf meals fed to the experimental broiler chickens is similar to those reported by [9].

3.2 Haematological Characteristics of Broilers

Table 1 shows results of the haematological characteristics of broiler chickens exposed to the experimental diets: T_1- non- supplementation with leaf meal) used as control and other feeds supplemented with different leaf meals: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) for 5 weeks after brooding (finisher phase).

The packed cell volume (PCV) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (P> 0.05) different. The PCV value of the broilers ranged from 31.00 – 33.33% for T_2 and T_1 respectively. The PCV values reported in the study for the broiler chickens were within the normal range (22 – 35%) reported by [10] for normal or healthy chickens. Similarly the values of PCV observed in this study for birds whose feeds were supplemented with Neem leaf meal (T_3) is within the range (30 – 40%) for broilers as reported by [1]. This implies that supplementation of broiler feeds with the different leaf meals has no deleterious effect on the broilers as they maintain their normal blood count [11].

The haemoglobin (Hb) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (*P*> 0.05) different. The haemoglobin value of the broilers ranged from 9.97 – 11.07 g/dl for T_4 and T_1 respectively. The haemoglobin values reported in the study for the broiler chickens were within the normal range (7.0 – 13.0 g/d) reported by [6] for normal or healthy chickens. This implies that supplementation of broiler feeds with the different leaf meals has no deleterious effect on the broilers [11].

The Red blood cells (RBCs) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (*P*> 0.05) different. The Red blood cells (RBCs) value of the broilers ranged from 3.40 – 3.70 x 10^{12}/l for T_4 and T_1 respectively. The Red blood cells (RBCs) values reported in the study for the broiler chickens were within the normal range (2.5 – 3.5 x10^{12}/l) reported by [10] for normal or healthy chickens. This implies that supplementation of broiler feeds with the different leaf meals has no deleterious effect on the broilers as they maintain their normal blood count [11].

The Mean corpuscular haemoglobin concentration (MCHC) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (*P*> 0.05) different. The Mean corpuscular haemoglobin concentration (MCHC) value of the broilers ranged from 32.13 – 33.20 g/100 ml for T_4 and T_2 respectively. The Red blood cells (RBCs) values reported in the study for the broiler chickens were within the normal range (26.0 – 35.0 g/100 ml) reported by [10] for normal or healthy chickens. This implies that supplementation of broiler feeds with the different leaf meals has no deleterious effect on the broilers as they maintain their normal blood MCHC [11].

The Mean corpuscular haemoglobin (MCH) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (*P*> 0.05) different. The Mean corpuscular haemoglobin (MCH) value of the broilers ranged from 28.47 – 30.83pg for T_4 and T_2 respectively. The Mean corpuscular haemoglobin (MCH) values reported in the study for the broiler chickens were lower than the normal range (33.0 – 47.0 pg) reported by [10] for normal or healthy chickens. This variation may be due to difference in the breeds of fowls [10].

The Mean corpuscular volume (MCV) value of the broilers fed with the experimental diets T_1 (leaf meal un-supplemented feed) and those supplemented with different leaf meal: T_2 (proprietary finisher basal feed supplemented with *Centrosema* leaf meal – PFBF + CLM), T_3 (proprietary finisher basal feed supplemented with Neem leaf meal - PFBF + NLM) and T_4 (proprietary finisher basal feed supplemented with *Aspilia* leaf meal - PFBF + ASLM) were not significantly (*P*> 0.05) different. The Mean corpuscular volume (MCV) value of the broilers ranged from 88.50 – 91.17fl for T_4 and T_2 respectively. However, although broilers in the T_1 and T_2 exhibited higher MCV values, those of T_3 and T_1 were still within the normal values for birds. No mortality was recorded; hence the experimental diets were not deleterious.

3.3 Pigmentation Pattern of External Parts of Broilers

Table 2 shows the pattern of pigmentation or colouration (white, fairly yellow or very yellow) of the external body parts (shank, skin, beak and ear lobe) of broiler chickens exposed to their basal feeds (non-supplemented/supplemented) with different leaf meals. Results from the visual

Table 1. Haematology of broiler chickens fed basal concentrate diets supplemented with different leaf meals

Parameters	Treatments					
	T1(PFBF)	T2 (PFBF + CLM)	T3 (PFBF + NLM)	T4 (PFBF + ASLM)	Mean	±SEM
PCV (%)	33.33	31.00	33.00	30.33	31.92	2.88
Hb(g/dl)	11.07	10.50	10.97	9.97	10.63	0.85
RBC $X10^{12}$/l	3.70	3.40	3.70	3.43	3.56	0.35
MCHC (g/100 ml)	33.17	33.13	33.20	32.13	32.91	1.04
MCH (pg)	29.90	30.83	29.70	28.47	29.45	1.17
MCV (fl)	90.13	91.17	89.27	88.50	89.77	0.90

PFBF = Proprietary broiler Finisher Basal Feed; NLM = Neem Leaf Meal; CLM = Centrosema Leaf Meal; ASLM = Aspilia Leaf Meal; PCV = Packed cell volume; Hb = Haemoglobin; RBC = Red blood cell; MCHC = Mean corpuscular haemoglobin concentration; MCH = Mean corpuscular haemoglobin; MCV = Mean corpuscular volume

Table 2. Visual appraisal of pigmentation of body parts of broiler chickens fed basal concentrate diets supplemented with different leaf meals

Treatment	Colour of external body parts											
	Shank			Skin			Beak			Ear lobe		
	W	FY	VY	W	FY	VY	W	FY	VY	W	FY	VY
T_1(PBFF only	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No
T_2 (PBFF + CLM	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
T_3 (PBFF + NLM)	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No
T_4 (PBFF + ASLM)	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No

PBFF = Proprietary broiler Finisher Basal Feed; NLM = Neem Leaf Meal; CLM = Centrosema Leaf Meal; ASLM = Aspilia Leaf Meal; W = White; FY = Fairly yellow; VY = Very yellow

appraisal revealed variations in the colour patterns of the treatment groups. It was observed that the leaf meal supplemented groups (T_2 = PFBF + CLM, T_3 = PFBF + NLM and T_4 = PBFF + ASLM) possessed yellowish pigmentations on their shanks, skin, beak and ear lobes. However, the degree of yellowness of these body parts slightly differed. Thus the T_2 (PFBF + CLM) treatment group showed very yellow (VY) colouration as compared to their fairly yellow (FY) (T_3 = PFBF + NLM and T_4 = PFBF + ASLM) counterparts. The body colouration of broilers in T_1 (PBFF only) showed white (W) colouration of the parts. The yellow pigmentation of the various leaf meal supplementation groups may be as a result of the presence some pigmenting agents in the different leaves [12]. This is can be attributed to the presence of different xanthophylls of the general family of carotenoids resulting in pigmentation of the skin, fat, breast, and shanks and egg yolk [1].

4. CONCLUSION AND RECOMMENDATIONS

The investigation on the blood parameters of broiler chickens fed leaf meal supplemented diets of Goat weed (*Aspilia africana)*, Neem (*Azadirachta indica*) and *Centrosema pubescence* showed normal blood values as recommended for healthy birds. This further confirms that the use of the leaf meals at 5% inclusion level in basal broiler feeds is not deleterious to birds. Similarly, it was revealed that broilers whose feed were supplemented with different leaf meals showed a better appeal of their carcasses for consumption. The carcasses of the leaf meal treatment groups were better because of the yellow pigmentation of the different body parts (shank, skin, beak and ear lobes) due to the presence of carotenoids in these leaves. This will be of a better advantage to the consumers because of the supply of vitamin A that is good for better vision. Poultry farmers can also incorporate them in their broiler chicken feeds as it can be of an additional advantage due to the attractiveness of their carcasses to consumers to improve their profit margins.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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