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CARCASS CHARACTERISTICS AND REPRODUCTIVE ORGAN DEVELOPMENT OF EGG-TYPE CHICKENS FED DIETS CONTAINING *Aspilia Africana*

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ABSTRACT

Ameliorating high feed cost in poultry production using alternative feedstuff cannot be overemphasized. Hence, this experiment was conducted to determine the effects of *Aspilia africana* leaf meal on carcass characteristics and reproductive organs of 192 twelve weeks old pullets for three months in a battery cage system erected in a pen. Dried *A. africana* leaves were milled and used to replace part of soybean meal at 0%, 10%, 20%, and 30% to form four different diets treatments A_0, A_1, A_2 and A_3, respectively. Allotted to each treatment were 48 birds divided into four replicates of 12 birds each. Data obtained were subjected to analysis of variance (ANOVA) in a Completely Randomized Design. Higher ($p<0.05$) values of live weight (1543.75 g, 1487.50 g and 1475.00 g) were recorded for birds fed diets containing up to 30% *A. africana* (A_1, A_2, A_3, respectively). The dressing percentage was higher ($p<0.05$) in birds fed 30% replacement when compared with birds on control diet. The cut-up-parts showed a significant difference ($p<0.05$) in the values of head, shank and back. Higher number of matured yolks was recorded for all groups of birds fed diets containing *Aspilia africana.* It was concluded that –Aspilia Africana-leaf meal can meal can replace soyabean meal up to 30% without any adverse effect of reproductive organ and carcass evaluation of egg type chicken.

Keywords: *Aspilia africana,* cut-up parts, egg-type chickens, live weight, organ weights, reproductive organs.

INTRODUCTION

Poultry production is usually geared towards provision of food for man and profit for the farmer. For poultry production to be profitable, feed resources must be accessible and relatively affordable. Most conventional feed ingredients get expensive and scarce when not in season. Soybean, groundnut and maize are suitable case studies. The exploitation of locally available and cheap feed resources helps to forestall the threat poses to the future of poultry production *(*Runjaic-Antic *et al.,* 2010*)*. A number of locally sourced feed ingredients have been considered in the past. These include leaf meals of some tropical legumes and browse plants capable of supplying proteins, minerals, antibiotics and so on (Oko and Agiang, 2011). Some plant materials are fortified with medicinal characteristics showing a wide

range of pharmacological effects such as anti-inflammatory agent, astringent, anti-diarrheal, digestion-stimulating, laxative, sedative, spasmolytic and choleretic properties (Hashemi *et al.,* 2008; Ranjaic-Antic *et al.,* 2010). Plant parts are also pigmented, containing oxy-carotenoids and xanthophylls (Zakynthinos and Varzakas, 2016).

Although, layers are basically raised for the production of eggs, the carcass of old layers is also useful for human consumption as meat which gives room for improving the carcass quality alongside improving its laying performance. The effect of different types of feed introduced to birds on body weights and other development indices cannot be overemphasized. It determines the quality and quantity of the breast muscle which is considered the most valuable products in the chicken industry (Simeneh, 2019). Therefore, quality feed is required to be administered to the birds for the establishment of a quality body frame to enhance the development of the bird's reproductive system and carcass characteristics and composition (Simeneh, 2019).

Considering the reduction in cost that can be made possible by the use of non-conventional poultry feeds, not undermining the nutritional needs of the birds, *Aspilia africana* could be reckoned with. It is a plant that contains a wide range of biological activity such as antiviral, fungicide and antibacterial due to the presence of thiarubrines, a derivative of 1,2-dithiocyclohexa-3,5-diene (Masato and Wu, 1994). The plant's crude protein is estimated at 20.65% according Adedeji *et al. (*2015), having the ability to enhance growth and improve the health of an animal at a reduced cost.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Institute of Food Security, Environmental Resources and Agricultural Research (IFSERAR), Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. The farm lies within Latitude 7^0 10^0 N longitude $3^0 2^{11}$ E and altitude 76 mm located within the derived savannah zone of south western Nigeria (Google earth, 2019). It has a humid climate with mean annual rainfall of 1037 mm and temperature of about 34^0C.

Experimental birds and management

The experiment was conducted on 192 pullets for 6 weeks. The pullets, sourced at point of cage (12 weeks old), were kept in battery cages and fed commercial feed for 2 weeks acclimatization period. Adequate fresh and clean water was supplied. The birds were administered anti-stress for three days, after which they were administered with anti-coccidiosis and dewormed for another three days. At 15^{th} and 16^{th} weeks of age, the birds were vaccinated against Newcastle disease and Infectious bursa disease, respectively. Four treatments of 48 birds each with a different diet were formed and each treatment was further divided into four replicates, each replicate having 12 birds.

Experimental diet

Aspilia africana shoot was collected and sun dried until it was crispy. The dried *A. africana* shoot was milled to powder and used to replace soybean meal at 0%, 10%, 20%, and 30% to form four different dietary treatments A_0, A_1, A_2 and A_3, respectively. The feeds were compounded under close moni-

Table 1: Composition of Diet used at Pullet stage

Feed Ingredients	A_0	A_1	A_2	A_3
Maize	42	42	42	42
Wheat bran	23	23	23	23
Soybean meal	15.1	13.59	12.08	10.57
Aspilia africana	0	1.51	3.02	4.53
Bone meal	2	2	2	2
Limestone	2	2	2	2
Lysine	0.2	0.2	0.2	0.2
Methionine	0.2	0.2	0.2	0.2
*Grower Premix	0.25	0.25	0.25	0.25
Palm kernel cake	15	15	15	15
Salt	0.32	0.32	0.32	0.32
Determined analysis				
Metabolisable energy, KCal/kg	2416.99	2416.94	2416.9	2416.85
Available phosphorus	0.43	0.43	0.44	0.44
Crude protein	15.93	15.53	15.12	14.69
Calcium	1.34	1.36	1.38	1.39
Crude fibre	5.89	5.88	5.87	5.86
Methionine	0.45	0.45	0.45	0.45
Lysine	0.9	0.88	0.85	0.82

*premix per kg: vitamin A, 8,000,000 iu; vitamin D3, 2,000,000 iu; vitamin E, 14,000iu; vitamin K, 1,600 mg; thiamine, 600 mg; riboflavin, 2,000 mg; niacin, 7,200 mg; pantothenic, 2,800 mg; vitamin B6, 800 mg; vitamin B12, 5meg; folic acid, 600mg; biotin, 2.8meg; choline chloride, 100,000 mg; cobalt, 200 mg; copper, 2,400mg; iodine, 440mg; iron, 8,000 mg; manganese, 32,000 mg; selenium, 80 mg; zinc, 20,000; antioxidant, 50,000 mg.

Carcass and reproduction evaluation

At 20 weeks of age, two birds of similar mean weight were picked per replicate for carcass evaluation. Feed was withdrawn from the birds 12 hours before slaughtering to ensure emptying of the digestive tract. The birds were slaughtered, defeathered and eviscerated. The weight was determined using sensitive scale and recorded. The cut-up parts (head, neck, breast, back, thighs, drumsticks, wings and shanks) and organs (gizzard, proventriculus, intestine, heart, liver, spleen and lung) were measured and calculated as a percentage of the live weight of the birds. Reproductive parts (oviduct length, oviduct weight, number of yellow yolks, number of white yolks, ovary weight, and abdominal fat) weight were also measured and recorded.

Table 2: Composition of Diet Used at Laying Stage

Feed Ingredients	**A_0**	**A_1**	**A_2**	**A_3**
Maize	50	50	50	50
Wheat bran	15	15	15	15
Soybean meal	17	15.3	13.6	11.9
Aspilia africana	0	1.7	3.4	5.1
Bone meal	2.5	2.5	2.5	2.5
Oyster shell	7.25	7.25	7.25	7.25
Lysine	0.2	0.2	0.2	0.2
Methionine	0.36	0.36	0.36	0.36
*Layer Premix	0.25	0.25	0.25	0.25
Palm kernel cake	7.19	7.19	7.19	7.19
Salt	0.25	0.25	0.25	0.25
Determined analysis				
Metabolisable energy, kCal/kg	2469.5	2470.4	2471.3	2472.2
Available phosphorus	0.46	0.46	0.47	0.47
Crude protein	14.87	14.4	13.92	13.42
Calcium	3.41	3.47	3.53	3.58
Crude fibre	4.49	4.46	4.42	4.38
Methionine	0.6	0.6	0.6	0.6
Lysine	0.87	0.84	0.81	0.78

*premix per kg: vitamin a, 4000000iu; vitamin d3, 800000iu; vitamin e, 4800mg; vitamin k3, 800mg; vitamin b1, 600mg; vitamin b2, 2000mg; vitamin b6, 600mg; vitamin b12, 4mg; niacin, 6400mg; folic acid, 240mg; biotin, 8mg; anti-oxidant, 40000mg; choline chloride, 60000mg; manganese, 32000mg; iron, 16000; zinc, 24000; copper, 3200mg; iodine, 400mg; cobalt, 100mg; selenium, 60mg.

Proximate analysis of* experimental diets *and Aspilia africana

The moisture content was lower in A_1 and A_3 relative to the control (Table 3). Dry matter content related inversely to moisture content. Fat contents were higher with A_1 and A_3 but lower in A_2 relative to A_0. Similar trend was observed for ash. The ash content in A_1 and A_3 were higher but lower in A_2, relative to A_0. The crude fibre, crude protein and carbohydrate contents were higher in A_1, A_2 and A_3 relative to the control diets. The energy content however was higher with A_1 and A_3 but lower in A_2 relative to A_0.

Table 3: Proximate analysis of *Aspilia africana*

Parameters	A_0	A_1	A_2	A_3	*Aspilia* leaf
Moisture Content (%)	15.89	12.55	16.13	12.86	18.27
Dry Matter Content (%)	84.11	87.45	83.87	87.14	81.73
Fat Content (%)	8.73	9.21	8.58	9.12	1.16
Ash Content (%)	4.61	4.96	4.24	4.89	2.67
Crude Fibre Content (%)	5.92	6.78	6.08	6.52	9.78
Crude Protein Content (%)	18.87	19.35	18.94	20.08	10.67
Carbohydrate Content (%)	45.98	47.15	46.03	46.53	57.25
Energy Content (Kcal/100g)	331.48	344.51	329.60	344.51	278.36

Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA), in a Completely Randomized Design (CRD). Significant means at $p<0.05$ were separated using Duncan's Multiple Range Test as contained in SAS (2012) software package.

RESULTS

There were significant differences in the values of live weight and dressed percentage of the birds at the end of the experiment (Table 4). Higher values of live weight (1543.75 g, 1487.50 g and 1475 g) were recorded for birds fed diets supplemented with 10, 20, and 30% A. *africana*, respectively. These values were significantly higher than the value from control (A_0) with 1387.5g birds. The highest dressing percentage of 70.76% was recorded in birds fed 30% which was not significantly different from other treatments except control. The cut-up parts in percentage of live weight showed significant differences for head, shank and back. The percentage heads from control and 30% replacement were higher when compared with that of 20% replacement birds, but similar to value recorded for birds fed with 10% supplement. Neck, thigh, drumstick, breast and wing percentages were not significantly affected by diets supplemented with 10, 20, and 30% A. *africana*. There were no significant differences in all the weights of internal organs measured (Table 5). The heart values ranged from 0.40 to 0.49% while that of liver ranged from 1.71 to 1.79%. The numerical differences noted in lung ranged from 0.54 to 0.60%. Least gizzard value of 3.39% was obtained in the control birds while the highest value of 3.57% was in birds fed with 20% supplement. The intestine value ranged from 5.32 - 6.48%, proventriculus ranged from 0.52 to 0.60% while spleen ranged from 0.14 to 0.21% (Table 5)

All reproductive organs determined were not significantly affected except in the number of matured yolks (Table 6). The highest number of matured yolks was from birds fed 20% replacement while the least was recorded in birds fed control diet. The range of oviduct weight was 45.38 - 54.50g while number of follicles ranged from 12.13 to 14.00. The numerical least abdominal fat value of 5.25g was obtained in the control birds while the birds on 30% replacement recorded the highest value of 14.00g (Table 6).

Table 4: Effects of *Aspilia africana* shoot meal inclusion in the diet of egg-type chicken, on the cut-up parts

Parameters	A_0	A_1	A_2	A_3	SEM
Live weight (g)	1387.50^{b}	1543.75^{a}	1487.50^{a}	1475.00^{a}	15.55
Plucked weight (%)	0.09	0.09	0.08	0.09	0.001
Eviscerated weight (%)	64.17	77.89	71.61	73.49	2.43
Dressing percentage	63.86^{b}	66.37^{ab}	67.13^{ab}	70.76^{a}	0.99
Cut up parts (% of live weight)					
Head	2.77^{a}	2.70^{ab}	2.50^{b}	2.82^{a}	0.04
Shank	3.34^{a}	3.17^{a}	3.13^{ab}	2.92^{b}	0.05
Back	15.85^{ab}	17.94^{a}	14.52^{b}	15.72^{ab}	0.55
Neck	5.66	4.92	4.44	9.74	1.28
Thigh	9.51	9.90	9.72	9.79	0.14
Drum stick	9.39	8.81	8.77	8.52	0.17
Breast	13.54	13.94	13.95	14.32	0.21
Wing	7.33	7.70	7.04	7.15	0.15

a,b means with different superscripts on the same row differ significantly ($p < 0.05$)

Table 5*:* Effect of *Aspilia africana* shoot meal inclusion in the diet of egg-type chicken, on organ weights

Organs (% live weight)	A_0	A_1	A_2	A_3	SEM
Heart	0.40	0.49	0.41	0.43	0.02
Liver	1.77	1.79	1.76	1.71	0.06
Lungs	0.58	0.56	0.54	0.60	0.02
Gizzard	3.39	3.40	3.57	3.52	0.08
Intestine	5.32	5.96	6.24	6.48	0.25
Proventriculus	0.60	0.59	0.54	0.52	0.02
Spleen	0.21	0.20	0.15	0.14	0.02

Table 6*.* *Aspilia africana* shoot meal inclusion in the diet of egg-type chicken, effects on the reproductive organs

Parameters	A_0	A_1	A_2	A_3	SEM
Oviduct length (cm)	56.93	59.78	57.75	61.59	1.43
Oviduct weight (g)	47.63	52.13	54.50	45.38	2.33
No of matured yolk	4.00^{b}	5.00^{ab}	5.50^{a}	4.38^{ab}	0.24
No of follicle	12.13	12.25	14.00	12.25	0.88
Ovary weight (g)	25.63	30.38	32.00	24.75	1.48
Abdominal fat (g)	5.25	8.13	10.00	14.00	1.87

a,b means with different superscripts on the same row differ significantly ($p < 0.05$)

DISCUSSION

There were significant effects of *Aspilia africana* shoot meal on the average live weight of the birds compared to birds in the control group. This is similar to the report of Agiang *et al.* (2011) who fed quails with aqueous extracts of *Aspilia africana* leaf meal supplements at different concentrations. The dressing percentage recorded in this study significantly increased from birds on control diet to birds on 30% inclusion level. In his research on *A. africana* as feed supplements to quail, Agiang *et al.* (2011) found that the dressed weight of quails significantly improved at increased levels of *A. africana* leaf meal supplementation. This is at variance with earlier reports that plant products had no significant effects on the body weight of birds (D'Mellow and Devandra, 1995; Alcicek *et al.*, 2004). Though the spleen weight observed in this study decreased from control birds to birds fed 30% replacement, there was no significant differences in the values among the treatments. This is in agreement with the work of El-Katcha *et al.* (2016), who reported a non-significant increase in spleen weight of broilers fed with garlic extract supplemented diets. One of the indicators of hens health and vigour is the proportional shape of the head, condition of comb and wattle and brightness of the eyes. Intensity of laying is determined by lack of fat under the shank scales and pigment loss over the entire shank. As more soybean, which is richer in crude protein is been replaced with Aspilia, which is low in crude protein, the crude protein level of feed decreased. This may be responsible for instances where low values were recorded for A_3 birds like in shank and some reproductive organ weight which numerically low. However, the crude protein level are still within the range required for layers. A significant decrease was observed in the value of shank weight with the increase in inclusion level of *A. africana*. Aderemi *et al.* (2017) also reported a significant decrease in shank weight of broiler chickens when fermented locust bean meal (*Parkia biglobosa*) was used to replace soybean meal in the diet.

The percentage of live weight for visceral organs (heart, liver, lungs, gizzard, intestine, proventriculus and spleen) of the laying birds were statistically similar. This means that *A. africana* has no anti-nutritional factors which could be harmful to the laying birds. Ismail *et al.* (2008), reported that the presence of trypsin inhibitor in legume seeds used in animal feeds and human foods causes growth depression, and relative smaller size of organ weights to live weight in broilers fed mucuna seed meal. Aderemi *et al.* (2017) also observed smaller size for visceral organs at 100% replacement of soybean meal with fermented locust bean meal in broiler chickens. Moreover, Ayssiwede *et al.* (2011) who fed Senegal birds with graded levels of Leuceana leaves meal also observed no adverse effect on dressing carcass, liver weight, heart, lungs and spleen weight. He reported that they were all increased in birds fed Leuceana leaves based diets with no significant difference among treatments compared to the control group. Although, the percentage of live weights for visceral organs were not significant, the values of heart, liver and gizzard were similar to the reported ranges of 0.3 - 0.4, 1.8 - 2.0 and 2.8 – 3.9 respectively by Osonu *et al.* (2007).

This study observed a numerical increment in oviduct weight from control to A_2 but a decline in A_3. Yang *et al.* (2016) also reported an increase in oviduct weight in brown Leghorn laying hens fed diets supplemented with 0 and 8.5 mg/kg of L-arginine but the

oviduct weight reduced as the inclusion of L-arginine increased to 17 mg/kg. This may be connected to the insignificant increment observed in groups of birds fed *Aspilia africana* over the control group. Obuzor and Ntui (2011) identifies 3 essential amino acids which include histidine, phenylalanine and arginine in the essential oil of *Aspilia africana* leaves.

CONCLUSION

This study revealed that inclusion of *Aspilia africana* in the diet of egg-type chicken up to 30% significantly affected the number of matured yolks. This study also discovered that *A. africana* leaf meal can substitute soybean meal in pullets' diets up 30% without any adverse effect on the cut-up parts, visceral organs and reproductive organs.

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