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Performance, Carcass and Organ Characteristics of Finisher Broilers Fed Graded Levels of Fern *(Asplenium barteri)* Leaf Meal

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Abstract

Asplenium barteri an evergreen ubiquitous terrestrial epiphytic fern commonly found in all the creeks of Niger Delta was prepared as Fern leaf meal (FLM) by sun drying freshly harvested fern leaves, milled and sieved. FLM was thereafter included into broiler diets as a protein source at 0%, 3%, 6%, 9% and 12%. All diets were isocaloric and isonitrogenous. A 49-day old feeding trial involving 105 day old Anak 2000 broiler chicks was carried out in a completely randomized design of five treatments with three replicates consisting of seven bird per treatment to evaluate the effect of fern leaf meal (FLM) at the stated dietary levels of inclusion on the performance, carcass and organ characteristics of broilers. Data was collected on feed intake, body weight gain, feed conversion ratio, carcass and organ characteristics. Feed intake of the birds on fern leaf meal were significantly ($p<0.05$) affected by the treatment. The cut-up parts of the carcass showed superior values ($P<0.05$) in the control diet and differed significantly ($P<0.05$) from broilers on diet 3%, 6%, 9%, and 12% FLM inclusion. It is recommended that 6% inclusion of FLM could be used in broiler starter and finisher diets as this inclusion level did not cause any deleterious effect on performance and carcass yield.

Keywords: Animal Feeds, Broilers, Fern Leaf Meal, Performance

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Introduction

The livestock industry has not been able to meet the animal protein requirement of the Nigerian populace because it has been confronted with major obstacle of high cost of conventional feeding stuff. This has further led to an increase in the prices of livestock feed and consequently the high cost of producing chicken and its parts (Keocha, 1982). The search for alternative feed ingredients including those that contain high crude protein content for livestock feeding especially non-ruminants has continued to attract the attention of researchers especially in the developing countries of the world, in view of this competition which exist between human and the livestock industry for cereal grains (Esonu, 1999). In the same vein, according to Oruseibio (1985), the search for least cost formulation has led animal nutritionists to investigate the nutritional potentials of non-conventional ingredients used for compounding animal rations and to evaluate the best possible combinations of such ingredients that could support satisfactory performance. Hence, there is the need to explore the nutritional potential of an affordable and available feed ingredient like aquatic weeds such as fern as leaf meal. Aquatic weeds may be used as feed ingredients (Purie, 1980), it may offer a fairly cheap feedstuff for poultry and can partly substitute the conventional and expensive dietary protein source for layers and broilers (Haustein *et al.,* 1990). Moreover, inclusion of aquatic plants at low levels in poultry diets had shown fairly good performance, especially when they supply part of the total protein or when they are included as a source of pigment for eggs and broiler skin (Maurice *et al.,* 1984). Aquatic plants species because of their growth habit appear not to accumulate secondary plant compounds and therefore offer a greater potential than tree leaves as a source of protein for monogastric animals (Maricel, *et al.,* 1995).

Asplenium barteri an evergreen terrestrial epiphytic fern is found in all continents except Antarctica. It is commonly found in the tropics and sub-tropics and grows naturally in stagnant water, canals, pond, rivers etc. Hence, the objective of the study was to evaluation the growth, performance, carcass yield and organ weights of broilers fed graded levels of fern (*Asplenium barteri*) leaf meal

Materials and Methods

A total of one hundred and five Anak 2000 day-old broiler chicks were weighed and randomly allotted to five dietary treatments with three replicate per treatment in a completely randomized design (CRD). Each replicate had seven birds so that there was a total number of twenty one birds per treatment. After the brooding week, the experiment lasted for seven weeks. A total of one hundred and five Anak 2000 day-old broiler chicks where obtained from Zartech Farms Limited, Ibadan. The birds were transported to the Niger Delta University Teaching and Research Farm where the research was carried out during the early wet season of March-April 2011. At the arrival of the birds, initial weight were taken and the birds were brooded for one week during which they were fed commercial starter diets before the experiment started. The chicks were reared in a well-ventilated deep litter house constructed with solid wooded concrete dwarf walls and wire gauze and erected from the top of the walls up to the roof of the building. The house was partitioned into five pens measuring 4×16m each and further sub-divided into three sub-partitions measuring 4×5.3m for each pen. All the pens were thoroughly washed and disinfected with Izal prior to the arrival of the birds. The floor of all the pens were covered with wood shavings up to a thickness or height of about 4-5cm. The chick feeders and drinkers were placed at central positions on the floor of each pen. Kerosene stoves and electric bulbs of 200 watts were also placed in each of the pens to provide supplemental heat for the chicks. After three weeks the stoves were removed while the electric bulbs were retained to supply light during the night hours. The birds were vaccinated against Gumboro on the fourteenth day and New castle disease on the twenty-first day.

The birds were group fed during the first one week of acclimatization with commercial type starter diet and were allocated at random to each of the experimental diets. The starter diet for the experiment was fed for the first three weeks after acclimatization while the finisher diet was fed for the last four weeks of the experiment. The fern leaves were harvested fresh from within the surrounding of the Niger Delta University Campus. The leaves were stripped off from the stem and air dried for about five to six hours daily for three-four days after which it was taken to milled and sieved. The different feed ingredient were bought from Elohim Farms in Yenagoa, Bayelsa State for milling and transported to the University Teaching and Research Farm were each of the feed ingredient was weighed and used to compound the different experimental diets. Graded levels of fern leaf meal (FLM) was used to replace soybean at the rate of 0%, 3%, 6%, 9% and 12% in the dietary treatment designed as T1, T2, T3, T4 and T5 respectively, of which T1 served as the control diet containing 0% of FLM or 100% soya bean meal. Table 1 and 2 shows the formulated ration for the starter and finisher phases of the experimental diets respectively.

The feed for each replicate was weighed and stored in a jute sac to last for one week. Each day it was ensured that there was enough feed and water accessible to the birds. At the end of the week, the remnant was weighed and recorded. The feed intake was determined by subtracting the initial feed weight from the remnant weight. This was done throughout the duration of the experiment. On the first and seventh day of the experiment, the initial weight of the birds were taken with a CS-2000 digital scale before the experiment began. Average body weight gain per bird was monitored by weighing the individual birds in each of the replicate on the seventh day of each week throughout the experiment. The cumulative weight for each replicate for each treatment was divided by the total number of birds in the respective treatments. The same birds used for blood parameters were also used for Carcass characteristics. The live weight of the birds were taken and they were then slaughtered by slitting the neck after the blood was drained off, they were placed into a boiling water for a minute after which they were properly de-feathered and weighed. The dressed carcasses

were eviscerated and the length and weight of the following part/organs were determined; the breast, gizzard, liver, kidney, lungs, spleen, small intestine, heart, drum stick, shank, head, neck, wings thigh, chest, liver, pancreas, proventiculus, ileocaecal joint, crop, caecum

The dried fern leaf meal, as well as experimental diets for both starter and finisher phases were subjected to proximate analysis according to the Official Method of Analysis (AOAC 1990). All the data were subjected to one way analysis of variance (ANOVA) in SPSS v.16.0 Computer programme and errors were calculated as Standard Errors of the Mean (SEM). Means were separated using the Duncan's Multiple Range Test as Outlined by Obi 1990, Significance was accepted at the 0.5 level of probability.

Results and Discussion

The results of proximate analysis of dried fern leaf and the experimental diet is presented in Table 3. While results for performance, carcass characteristics and organ weights are presented in Tables 4, 5, 6, 7 and 8 respectively. The results in Table 3 shows that dried fern (*Aspelnium barteri*) was lower in, crude fiber (14.84%), ether extract (3.0%) ash (7.20%) and crude protein (9.63%) compared to *Azolla pinnata* with (25.78%) crude protein, (15.71%) crude fiber, (3.47 %) ether extract, (15.76%) ash, respectively, exception of nitrogen free extract with 53.54% and 30.08% for *Aspelnium barteri* and *Azolla pinnata* respectively (Basak *et al.,* 2002). The result from Table 4 shows that initial live weight, body weight gain, and feed intake, are significantly different among the treatments but the control was superior in values followed by T3, T2, T4 and T5 respectively, but for FCR, where T5 was superior. The depression in growth with 9% and 12% levels of fern leaf meal agrees with the general observations that at high leaf meal inclusion levels in poultry diet, the growth is depressed (D' Mello, *et a*l 1989; Ash and Akoh, 1992; Opara 1996). D' Mello *et al.* (1987) reported that a diet containing 10% leaf meal of *Leuceana lecucocephala* significantly depressed the body weight gains of birds without affecting dry matter intake. (Cheeke *et al*., 1988) reported a 71% depressed growth rate in chickens fed diet containing 20*% Robina acacia* leaf meal when compared with control (0%) group. The body weight gain at 6% fern inclusions was similar with the result of Basak *et al.* (2000) who reported higher values for *Azolla pinnata* fern as feed ingredient in broiler ration. But Bested and Morento (1985) stated that *Azolla* fern affected the palatability of the feed and reduced feed consumption. The feed conversion ratio observed in the diet of 9% and12% fern inclusion disagrees with the result by Basak *et al.* (2000) who reported a decrease in FCR of 10% and 15% inclusion of *Azolla* fern leaf meal.

The dressed weight of broilers expressed as live weight per kg were similar among groups, this is in line with the finding of Nwoche *et al.* (2006) in broiler finisher birds. The birds on control (0%) fern inclusion showed superior values ($P<0.05$) in the weight of the cut parts of the carcass. There were no significant differences ($P>0.05$) among other treatment groups. The depressed weight of the carcass cut parts may be as a result of low feed intake (Esonu *et al.,* 2002).

Conclusion and Recommendations

The result of the proximate composition revealed that fern leaf meal is a potentially source of nutrient in monogastric feed formulation. Though further research is necessary to determine how to increase the utilization and nutritive value of fern leaf meal for monogasric animals in view of its abundance. It is recommended that 6% inclusion level of fern leaf meal could be used in broiler starter and finisher diets without any deleterious effect on performance, organ weights and carcass yield of broiler birds.

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Tables

Table 1: Composition Of Broiler Starter Diet (G/Kg)

Ingredients	**T1 (0%)**	**T2 (3%)**	**T3 (6%)**	**T4 (9%)**	**T5 (12%)**
Maize	49.00	49.00	49.00	49.00	49.00
Soya Bean Meal	20.00	18.50	17.50	16.50	14.00
Groundnut Cake	10.00	9.25	7.25	6.25	5.00
Wheat Offal	7.25	6.50	7.00	6.50	6.25
Palm Kernel Cake	6.50	6.50	6.00	7.50	6.50
Fish Meal	4.00	4.00	4.00	4.00	4.00
Bone Meal	2.50	2.50	2.50	2.50	2.50
Vit. &Min. Premix	0.30	0.30	0.30	0.30	0.30
NaCl (Salt)	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Fern *(A. barteri)*	-	3.00	6.00	9.00	12.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Nutrient Composition:					
Crude Protein %	22.11	22.17	22.27	22.10	22.12
Crude fiber %	3.78	. 06	4.17	4.28	4.39
Ether Extract %	4.47	6.87	8.03	9.04	9.15
ME (kcal/kg)	2990.32	2980.68	3000.00	2999.36	2890.95

Vitamin premix: Calpan-10,100mg; vitamin B_2-8,000mg; Vitamin B_{12} -20mg; Vitamin B_1 -3000mg; vitamin B_6 -4,000mg, Biotin- 30, Antioxidant – 125,000mg. Mineral premix ; Cobalt – 240mg; Selenium-300mg; Iodine -1, 400mg; Iron 40,000 mg; Manganese-96,000mg; Copper-6,000mg; Zinc-80,000mg; Chlorine Chloride -500,000 mg;

Table 2: Composition Of Broiler Finisher Diet (G/Kg)

Ingredients	**T1 (0%)**	**T2 (3%)**	**T3 (6%)**	**T4 (9%)**	**T5 (12%)**
Maize	56.00	56.00	56.00	56.00	56.00
Soya bean meal	18.00	17.50	16.00	15.00	14.00
Wheat Offal	7.00	7.00	7.00	6.00	14.00
Palm kernel Cake	6.50	5.50	4.50	3.50	3.00
Groundnut cake	5.50	4.50	4.00	3.00	2.50
Fish Meal	3.00	3.00	3.00	3.00	3.00
Bone Meal	2.75	2.75	2.75	2.75	2.75
Vit. &Min. Premix	0.30	0.30	0.30	0.30	0.30
NaCl(Salt)	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Fern *(A.barteri)*	-	3.00	6.00	9.00	12.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Nutrient Composition:					
Crude Protein %	19.24	19.14	19.23	19.14	19.12
Crude fiber %	3.26	3.89	4.17	4.28	4.38
Ether Extract %	3.86	4.15	6.75	7.79	8.83
ME (kcal/kg)	2920.30	3000.30	3009.13	3087.17	3109.30

Vitamin premix: Calpan-10,100mg; vitamin B_2-8,000mg; Vitamin B_{12} -20mg; Vitamin B_1 -3000mg; vitamin B_6 -4,000mg, Biotin- 30, Antioxidant – 125,000mg. Mineral premix ; Cobalt – 240mg; Selenium-300mg; Iodine -1, 400mg; Iron 40,000 mg; Manganese-96,000mg; Copper-6,000mg; Zinc-80,000mg; Chlorine Chloride -500,000 mg

Table 3: Proximate composition of (Dried) Fern

Constituent	**Percentage**
Dry Matter	90.24
Crude Protein	9.63
Ether Etract	3.0
Crude Fibre	14.84
N.F.E	55.57
Ash	7.20
Total	**100**

Table 4 Effect of Diet on Performance Characteristics

Parameters	**T1 (0%FLM)**	**T2 (3%FLM)**	**T3 (6%FLM)**	**T4 (9%FLM)**	**T5 (12%FLM)**
Initial live wt (gm/bird)	141±0.35^{a}	1139±1.56^{a}	114±0.23^{b}	140±0.35^{a}	138±0.23^{a}
Final live wt. (gm/bird)	244±0.64^{a}	90±0.43^{b}	205±0.64^{a}	109±0.32^{b}	170±0.44^{c}
Weekly body wt (gm/bird)	9.09±2.00^{a}	7.81±2.00^{b}	7.83±2.00^{b}	7.27±2.00^{b}	6.60±2.00^{c}
Feed intake (gm/bird)	4.32±3.00^{a}	3.08±3.00^{b}	4.30±3.00^{a}	3.79±3.00^{b}	3.70±3.00^{b}
FCR	5.48±25^{c}	6.04±0.51^{b}	6.09±0.24^{b}	6.00±0.31^{b}	6.79±0.62^{a}
Mortality %	0	0.02	0.03	0.02	0.01

Means in the same row with different superscript are significantly different from ($p< 0.05$)

Table 5: Effect of Diet on Carcass Characteristics

Parameters	**T1 (0%FLM)**	**T2 (3%FLM)**	**T3 (6%FLM)**	**T4 (9%FLM)**	**T5 (12%FLM)**
Live wt. (Kg)	2.325±19.97	2.05±13.35	2.15±21.33	2.00±29.12	1.97±31.43
Plucked wt. (kg)	2.20±43.50	1.85±1.53	1.94±7.5	1.80±51.59	1.85±3.65
Eviscerated wt.(kg)	1.60±74.48	1.405±46.29	1.405±53.47	1.33±34.72	1.315±33.74
Visceral mass (g)	403.5±2.52	320±14.17	342±21.13	357.5±16.19	376.5±19.31
Thigh (g)	251.3±30.59	206±1.15	224±42.63	215.5±31.42	226.3±29.42
Drum stick (g)	219.5±26.54	205.6±18.48	199.4±23.83	176.5±19.65	178.5±23.47
Head (g)	83.5±6.76	73.5±4.00	82±11.44	67.8±5.44	80.5±2.62
Neck (g)	75.5±5.25	56.3±42.62	58.3±58.74	55.5±62.42	46.5±60.07
Shank (g)	116.5±9.08	103.5±6.56	116.7±45.4	104.7±32.09	80.3±11.03
Wing (g)	208.5±2.64	177.4±13.18	179.3±21.15	182.5±26.08	209.45±18.31
Chest (g)	395.5±56.72	400.5±73.65	405.5±76.86	337.5±45.76	349.5±41.19
Back (g)	341.4±4.98	280.5±76.31	319.4±9.65	258.3±56.65	237.5±43.09
Belly fat (g)	12.7±2.09	14.3±6.08	13.7±5.07	31.3±11.8	60.3±9.03

Means in the same row with different superscript are significantly ($p< 0.05$)

Table 6: Effects of Diets on Organ Weights (g)

Parameters	T1 (0%FLM)	T2 (3%FLM)	T3 (6%FLM)	T4 (9%FLM)	T5 (12%FLM)
Gizzard (g)	71.2±10.05	67.1±3.01	66.5±8.63	63.6±7.75	72.3±3.73
Liver (g)	57.3±5.27	39.8±5.7	45.9±11.0	38.4±9.31	39.3±8.67
Caecum (g)	24.5±0.58	22.6±2.08	20.5±1.09	17.5±1.12	21.5±1.32
Heart (g)	12.7±2.75	7.5±1.09	11.5±1.69	12.4±3.08	8.5±1.00
Spleen (g)	2.5±0.032	2.1±06.00	3.2±1.57	2.5±00.57	2.5±0.59
Pancreas (g)	5.5±0.50	4.1±0.04	6.5±0.67	5.0±0.37	5.3±1.06
Lungs (g)	13.5±0.3	11.5±0.32	10.5±0.73	8.5±0.07	13.5±0.75
Small & large	192.5±0.43	221.5±0.31	213.3±0.10	211.3±0.48	164.5±0.34
Kidney (g)	10.5±0.64	11.5±0.53	9.5±0.23	8.3±0.76	10.1±0.21
Proventiculus	14.3±0.34	13.5±1.45	11.4±1.23	9.5±2.12	10.5±0.54
Ileocaecal juctn.	15.4±3.33	17.5±2.06	20.5±3.12	17.5±2.45	20.3±3.24
Crop (g)	15.6±1.24	11.3±0.21	9.5±1.32	14.4±1.48	17.5±2.43

Means in the same row with different superscript are significantly ($p< 0.05$)