Effect of Untreated and Alkaline Treated Melon Husk Diets on the Hematological Indices and Blood Chemistry of Broilers, Metabolic Trial, and Muscle PH

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Abstract— *The high cost of feed ingredients is one of the most significant hurdles to livestock production in underdeveloped countries. This study examined the effect of untreated and alkaline treated melon husk diets on the hematological indices and blood chemistry, metabolic trial, and muscle pH of broilers. The five diets contained a control diet of 0% level of inclusion of melon husk, 10% and 20% of untreated melon husk; 10% and 20% level of inclusion of Alkaline treated melon husk as a replacement for maize. The value obtained for the single effect of level of inclusion for ether extract and the nitrogen-free extract was significantly affected (P < 0.05). However, the highest value of the interaction for feed intake was recorded in the treated diet while the control diet recorded the highest value. The pH values obtained two hours after slaughtering for control, untreated, and treated diets were found to be significantly affected (P < 0.05), and the pH value obtained four hours after slaughtering was not significantly affected. Therefore, blood parameters were found to be superior in the diet containing melon husk to control diet while the muscle pH is not adversely affected.*

Keywords— blood chemistry, hematological, melon husk, metabolic trial, muscle pH.

I. INTRODUCTION

The high cost of feed ingredients is one of the most significant hurdles to livestock production in underdeveloped countries. Unfortunately, nearly all agricultural by-products and plant protein sources have high fiber and anti-nutritional elements that must be removed using particular processing processes in order for them to have optimal nutritional value. According to many researchers [1, 6, 3, 2, and 5], water soaking, autoclaving, and cooking in boiling water, steaming, radiation, and acid or alkaline treatment are among the most common processing procedures used to improve nutritive value. As a result, efforts should be focused on lowering feed costs, which account for roughly 70% of total production costs [7]. Alternative feed additives for chicken have been evaluated by researchers in a concentrated effort [8]. As a result, such alternatives should be less expensive than traditional component sources, have comparable nutritional value, and be widely available. In the search for cheaper feed components, researchers are looking into replacing traditional feedstuffs with less expensive alternatives in the formulation of chicken feed.

Due to the caustic nature of sodium hydroxide and its expensive cost, however, organic waste ash has been used as an alternate source of alkali for the treatment of crop residues. It has been explored whether cocoa pod ash may be used as an alkali for the treatment of cocoa husk [9]. Although, a previous study confirmed that melon husk that has been alkaline treated can be utilized to substitute maize for up to 20% without affecting the birds' performance or carcass characteristics

[4]. This study, therefore, aims at investigating the effect of untreated and alkaline treated melon husk diets on the hematological indices and blood chemistry, metabolic trial, and muscle pH of the broilers.

II. RESEARCH METHODS

The study was placed at the University of Agriculture poultry/feed mill unit at Kotopo, Abeokuta, Odeda Local Government, Ogun State, Nigeria. 180 unsexed day-old broiler chicks were bought from a commercial hatchery in Abeokuta and were brooded for a week before the experiment began (Anak 2002 strain). The birds were brooded together on a deep litter floor and fed the control food from day one to day seven. The birds were randomly divided into 5 groups of 36 birds per treatment and 12 birds per replicate at the end of the 7-day brooding period. Each set of 36 birds was fed five (5) different experimental diets, one of which included melon husk, which was purchased from the University of Agriculture Abeokuta's Research Farm. The Husk was sun-dried for 5 days before being alkaline treated. Four kilograms of sun-dried melon Husk were burned to ash and one kilogram of ash was delivered. 300 grams of ash were well mixed with 3 kilograms of ground melon husk Sand that had been soaked in 10 liters of water for seven days. The solution was stirred three times a day, or every eight hours. The alkaline treated melon husk was drained to eliminate water and sun-dried for 5 days at the conclusion of the 7th day. The alkaline-treated melon husk samples were taken to the lab for proximate analysis. Both sun-dried alkaline treated melon husk and untreated melon husk were utilized to substitute maize in the diet at 10% and 20% untreated, 10% and 20% treated, respectively. Water was provided ad libitum and the diets were made to be isonitrogenous and isocaloric. Each replicate's feed consumption and live weight increase were measured on a weekly basis. As a result, a weekly record was kept. Feed intake was estimated by subtracting leftover feed from the amount of feed provided.

The feed conversion ratio was calculated by dividing the amount of food consumed by the amount of weight gained. 15 birds (3 birds per treatment) were randomly selected for carcass analysis at the end of the seventh week. The birds were individually weighed (live weight), slaughtered, and eviscerated. Slaughtering was accomplished by severing the jugular vein, whereas evisceration was accomplished by cutting through the abdomen region and removing the internal organs, which were then weighed on a delicate scale. The dressed weight was taken, as well as the weight of internal organs such as the gizzard, liver, and heart, as well as the length and weight of the small, large, and caeca intestines. In a complete randomized design, statistical analysis was performed using the analysis of variance using a 2 X 3 factorial arrangement model, and the separation of significant differences among the means was performed using the computer application Minitab release 7.1.

III. RESULTS AND DISCUSSION

3.1 Hematology and Blood Chemistry

The result of hematological indices and blood chemistry are shown in Tables 1 and 2 as influenced by the level of inclusion, treatment, and interaction of the two factors. The value obtained for the single effect of level of inclusion was found to be significantly affected ($P < 0.05$) for all the parameters observed (Table 1), leading to an increase in the concentration of all the parameters observed except the white blood cell count where the concentration was found to be reduced. The effect of treatment did not significantly affect the diet. However, the white blood cell was found to be increased as a result of the treatment (Table 1). The interaction of the two factors (Table 2) showed that the result obtained for TP, Albumin, Globulin, Urea, Creatinine, Packed Cell Volume, hemoglobin, and Red blood cell was not significantly affected ($P > 0.05$) by the diet. The highest value of TP of 55.00 was recorded in both the 10% level of inclusion of untreated diet the and 20% level of inclusion of treated diet. This trend was also observed in the values obtained for albumin, globulin, urea, creatinine, packed cell volume, hemoglobin, red blood, and white blood cell. The control diet recorded the least values for all the parameters observed except the white blood count. It could also be observed that most of the values obtained for all the parameters were higher in the untreated diet at both levels of inclusion than values obtained at both levels of inclusion in the treated diet. However, in the case of white blood count, the highest value of 6600 m1/mm3 was recorded in the treated diet at both levels of inclusion while the least value of 6000 m1/mm3 was recorded in the untreated diet at a 10% level of inclusion.

Furthermore, all the values obtained for white blood cell counts in the experiment were found to be significantly affected ($P < 0.05$) by the diet.

TABLE 1
SINGLE EFFECT OF LEVEL OF INCLUSION AND TREATMENT ON HEMATOLOGICAL INDICES AND BLOOD CHEMISTRY OF BROILER CHICKENS FED WITH UNTREATED AND ALKALINE TREATED MELON HUSK DIET

Parameters	Effect of level inclusion				Effect of treatment		
	Level of Inclusion (%)						
	0	10	20	SEM	Untreated	Treated	SEM
Total Protein (mg/d1)	47.67^{b}	53.00^{a}	54.33^{a}	0.92	52.11	51.22	1.35
Albumin (mg/d1)	28.67^{b}	32.17^{a}	32.83^{a}	0.59	31.44	31.00	0.84
Globulin (mg/d1)	18.67^{b}	20.83^{a}	21.50^{a}	0.42	20.56	20.11	0.58
Urea (mg/1)	24.00^{b}	27.17^{a}	27.83^{a}	0.37	26.33	26.33	0.67
Creatinine (mg/d1)	1.07^{b}	1.23^{a}	1.28^{a}	0.22	1.19	1.20	0.03
Packed cell volume (%)	29.67^{b}	32.67^{ab}	32.67^{a}	0.59	32.33	31.67	0.85
Hemoglobin (mg/d1)	9.09^{b}	10.92^{a}	11.27^{a}	0.17	10.81	10.58	0.29
Red blood cell (ml/mm^3)	3.37^{b}	3.72^{ab}	3.72^{a}	0.59	3.67	3.57	0.09
White blood cell (ml/mm^3)	6400.00^{a}	6000.00^{b}	6600.00^{a}	73.00	6333.30	6533.30	70.50

^{abc} ***Means in the same row are not significantly different (P > 0.05)***

TABLE 2
INTERACTION EFFECT ON HEMATOLOGICAL INDICES AND BLOOD CHEMISTRY OF BROILER CHICKENS FED WITH UNTREATED AND ALKALINE TREATED MELON HUSK DIET

Parameters	Untreated melon husk			Treated melon husk			
	Level of Inclusion (%)						
	0	10	20	0	10	20	SEM
Total Protein (mg/d1)	47.67	55.00	53.67	47.87	51.00	55.00	1.36
Albumin (mg/d1)	28.67	33.33	32.33	28.95	31.00	33.33	0.85
Globulin (mg/d1)	18.67	21.67	21.33	18.84	20.00	21.57	0.58
Urea (mg/1)	24.00	27.67	27.33	24.10	26.67	28.23	0.73
Creatinine (mg/d1)	1.07	1.27	1.23	1.17	1.20	1.33	0.06
Packed cell volume (%)	29.67	34.00	33.33	29.78	31.33	34.00	0.59
Hemoglobin (mg/d1)	9.90	11.40	11.13	9.95	10.43	11.40	0.19
Red blood cell (ml/mm^3)	3.37	3.90	3.73	3.57	3.53	3.80	0.06
White blood cell (ml/mm^3)	6400.00^{a}	6000.00^{b}	6600.00^{a}	6400.00^{a}	6600^{a}	6600^{a}	73.20

3.2 Metabolic Trials

The mean value obtained for the metabolic trials as influenced by the two factors and their interaction is shown in Table 3. The result indicated that the value obtained for the single effect of level of inclusion for ether extract and nitrogen-free extract were significantly affected ($P < 0.05$). Furthermore, the value obtained for feed intake increased as the level of extract, crude fiber, and nitrogen-free extract decreased as the level of inclusion increased. However, the value obtained for crude protein retention increased as the level of inclusion increased though it was found not to be significant. However, the result of the single effect of treatment on all the parameters showed that the values obtained for all the parameters observed were decreased as a result of the treatment except for the value obtained for feed intake and dropping which increases as a

result of the treatment. The interaction of the two factors (Table 4) showed that the highest value for feed intake of 1 00.69 g per bird was recorded in the treated diet while the control diet recorded the highest value of dry matter digestibility (81.70%). The highest value of 81.58% crude protein retention was recorded in the control diet while the lowest value of 73.59% was recorded in the treated diet at a 10% level of inclusion, it could also be seen that the values obtained for the crude protein digestibility in the untreated diet were higher than the values obtained in. the treated diet.

The highest value of 98.95% obtained for ether extract was recorded in the untreated diet at a 10% level of inclusion while the lowest value of 96.98% was recorded in the 20% level of inclusion of the treated diet. However, the highest value recorded for both crude fiber and nitrogen-free extract 65.71% and 46,27% respectively was found in the control diet. Furthermore, it could be seen that while the value obtained for crude fiber in the 10% level of inclusion of the treated diet 60.80% was higher than the corresponding10% level of inclusion of untreated diet 48. 69%, the value obtained for nitrogen-free extract at the same 10% level of inclusion of untreated diet 3 5.40% was higher than that of treated diet at the same 1% level of inclusion 32.84%. There was no significant effect ($P > 0.05$) on all the parameters observed as a result of the interaction between the two factors.

TABLE 3
SINGLE EFFECT OF LEVEL OF INCLUSION AND TREATMENT ON METABOLIC TRIALS OF BROILER CHICKENS FED WITH UNTREATED AND ALKALINE TREATED MELON HUSK DIET

Parameters	Effect of Level of Inclusion				Effect of Treatment		
	Level of Inclusion (%)						
	0	10	20	SEM	Untreated	Treated	SEM
Feed intake g/bird	89.58	81.61	90.61`	3.97	81.51	90.55	2.79
Droppings g/bird	10.97	14.72	20.72	1.44	11.20	15.67	1.14
Dry matter digestibility (%)	81.58	72.25	75.32	1.97	78.74	77.36	1.83
Crude protein digestibility (%)	90.55	88.33	87.14	0.48	88.11	86.47	0.66
Ether extract (%)	98.55^{a}	98.57^{a}	97.49^{b}	0.13	98.48	97.93	0.19
Crude fibre (%)	66.49^{a}	54.75^{ab}	41.16^{b}	2.38	55.19	53.07	4.85
Nitrogen free extract (%)	47.07^{a}	34.12^{ab}	22.79^{b}	4.90	37.72	31.60	6.01

^{abc}***Means in the same row are not significantly different (P > 0.05)***

TABLE 4
INTERACTION EFFECT ON METABOLIC TRIALS OF BROILER CHICKEN FED WITH UNTREATED AND ALKALINE TREATED MELON HUSK DIETS

Parameters	Untreated melon husk			Treated melon husk			
	Level of Inclusion (%)						
	0	10	20	0	10	20	SEM
Feed intake g/bird	89.58	81.61	83.61`	89.90	95.50	100.69	5.63
Droppings g/bird	10.97	14.72	20.93	10.99	18.80	20.91	7.51
Dry matter digestibility (%)	81.58	80.90	73.73	81.70	73.59	76.92	2.08
Crude protein digestibility (%)	92.55	91.70	88.66	91.67	89.34	89.66	1.12
Ether extract (%)	98.49	98.95	98.01	98.69	98.18	96.98	0.27
Crude fibre (%)	65.71	48.69	51.17	65.79	60.80	31.15	6.02
Nitrogen free extract (%)	46.27	35.40	31.47	46.37	32.84	14.10	5.42

3.3 Muscle PH

Tables 5 and 6 show the result of the effect of the level of inclusion, treatment, and the interaction of the two factors on the thigh muscle pH of the bird at the expiration of the experiment. The result indicated that as the level of inclusion increased, the pH values obtained also increased. Furthermore, the values obtained two and four hours after slaughtering were found to be significantly affected ($P > 0.05$) thus slightly increasing the pH. The result of the single effect of treatment shows that the pH value obtained at initial, two, and four hours after slaughtering, were higher in the treated than in the untreated diet. The interaction of the two factors showed that the highest pH of 5.78 was recorded four hours after slaughtering in the 20% level of inclusion of the treated diet while the lowest pH of 5.29 was recorded as initial in the 10% level of inclusion of untreated diet. Furthermore, all the pH values obtained two hours after slaughtering for control, untreated, and treated diets were found to be significantly affected ($P < 0.05$). Whereas the pH value obtained for all the experimental diets four hours after slaughtering was not significantly affected.

TABLE 5
SINGLE EFFECT OF LEVEL OF INCLUSION AND TREATMENT ON THE PH OF THE THIGH MUSCLE OF CHICKEN FED UNTREATED AND ALKALINE TREATED MELON HUSK

Hours	Effect of Level of Inclusion					Effect of Treatment	
	Level of Inclusion (%)						
	0	10	20	SEM	Untreated	Treated	SEM
0	5.39	5.43	5.59	0.05	5.38	5.57	0.03
2	5.66	5.51	5.62	0.04	5.52	5.68	0.03
4	5.51ab	5.42ab	5.66a	0.04	5.51	5.55	0.03

a,b,c means in the same row with different superscripts differ significantly (P < 0.05)

TABLE 6
INTERACTION OF EFFECT ON THE PH OF THE THIGH MUSCLE OF BROILER CHICKEN FED WITH UNTREATED AND ALKALINE TREATED MELON HUSK DIET

Hours	Untreated Melon Husk			Treatment Melon Husk			
	Level of Inclusion (%)						
	0	10	20	0	10	20	SEM
0	5.39	5.29	5.44	5.45	5.57	5.76	0.10
2	5.66a	5.31b	5.58a	5.80a	5.71a	5.66a	0.04
4	5.51	5.48	5.55	5.71	5.37	5.78	0.07

a,b,c means in the same row with different superscripts differ significantly (P < 0.05)

IV. CONCLUSION

The results showed that the blood parameters were found to be superior in the diet containing melon husk to the control diet while the muscle pH is not adversely affected. Albumin, globulin, urea, creatinine, packed cell volume, hemoglobin, red blood, and white blood cell levels all followed this pattern. Except for the white blood count, the control diet had the lowest values for all of the parameters measured. It was also noted that the majority of the values obtained for all parameters were higher in the untreated diet at both levels of inclusion than the values obtained in the treated diet at both levels of inclusion. Performance in terms of feed intake and weight gain is as good as in the control diet where there is no melon husk. It is also observed that the effect of treatment greatly increases feed intake in the birds. Conclusively, all the pH values obtained two hours after slaughtering for control, untreated, and treated diets were found to be significantly affected ($P < 0.05$). Whereas the pH value obtained for all the experimental diets at four hours after slaughtering was not significantly affected. From this study, it has been shown that Alkaline treated melon husk can be used to replace maize up to a 20% level of inclusion without adverse effects on performance, hematology, and blood chemistry as well as on the muscle pH of the birds.

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