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Effects of dietary inclusion of avocado seed meal (*Persea americana)* on the carcass yield and haematological profile of broiler chickens

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Abstract

The purpose of this study was to evaluate the effect of Avocado Seed Meal (ASM) on the haematological parameters as well as the carcass yield of broilers. One hundred and twenty, one day-old broiler chicks of the cobb breed were used for this experiment. The chicks were allocated to four different treatments T_1, T_2, T_3 and T_4 fed with diets containing 0%, 0.5%, 1.0% and 1.5% ASM, respectively. The experiment lasted for a period of eight weeks and the data obtained were statistically analyzed. The result showed that the live weight and carcass weight of the birds were not significantly ($P>0.05$) affected by the experimental diet. Feed cost (N/kg) and feed cost per weight gain (N/kg gain) were highest in the control treatment which decreased as the level of ASM in the diet increased. The result also showed significant difference ($P<0.05$) in the WBC, platelets, neutrophils and lymphocytes while the RBC, PCV, Hb, MCV and MCH did not differ significantly ($P>0.05$). The results of this study showed that ASM can be incorporated up to 1.5% (15g/kg feed) of the feed, without any deleterious effect on the haematology of the birds.

Keywords: Avocado seed, carcass yield, haematological profile

Introduction

There is increasing pressure to reduce or eliminate the use of antibiotics in poultry feed due to the claimed negative effects on human health arising from antibiotic resistance (Javandal`*et al*., 2008). This has left poultry producers looking for alternatives to antibiotics that are relatively cheaper and with minimal residual effect. Use of antibiotics that might result in deposition of residues in meat, milk and eggs must not be permitted in food intended for human consumption. If use of antibiotics is necessary as in prevention and treatment of animal diseases, a withholding period must be observed until the residues are no longer detected. There is a variety of potentially useful feed materials that could be added to poultry feed in order to improve production and also reduce the spread of diseases. One of such feed material/ingredient is the Avocado seed meal (ASM). Consumption of Avocado (*Persea Americana*) has increased worldwide in recent years. The Avocado seed is obtained from the fruit, which is very nutritious, high in unsaturated fat and at their buttery best when used in raw preparation but when they are cooked for very long periods, their delicate flavor is diminished and in some instance they become bitter (Morton, 1987). In the avocado industry the pulp is used, while the skin and the seed are discarded as waste. These residues are rich in polyphenols with antioxidant and antimicrobial power (Rodriguez-carpena *et al.,* 2011). A 100g of dried APSM contains about 49.03g of carbohydrate, 17.90g of lipid, 15.55g of protein, 2.26g of ash, 15.10g of moisture (Ejiofor, *et al.,* 2018). Higher values of anti-nutritional factors such as tannin oxalate and phytic acid (11.2g/100g, 4.07g/100g and 12.87g/100g), respectively have been reported to be present in avocado seed (Adegoke *et al.,* 2012). However, boiling

the seed for 25 minutes or soaking for 24 hours effectively reduced the anti-nutritional factors without any adverse effect on the nutritional quality of the seed. The anti-nutritional components of *Terminaliacatappa* (almond) seeds show higher values when compared to those of avocado seeds (Akpabio, 2012). The Avocado seed contains antimicrobial, anti-oxidative and a substantial content of nutrients that warrant its trials and utilization in feed formulation. Analysis of normal haematological parameters of chickens is essential for the diagnosis of various pathological and metabolic disorders (Elagib and Ahmed, 2011). It can be used as a diagnostic tool in order to assess the impact of environmental, nutritional and pathological stresses. Haemtological studies are useful in the diagnosis of many diseases as well as investigation of the extent of damage to blood (Onyeyili*et al.,* 1992; Togun*et al.,* 2007). Haematological components, which consist of red blood cells, white blood cells or leucocytes, mean corpuscular volume, mean corpuscular haemoglobin are valuable in monitoring feed toxicity especially with feed constituents that affect the blood as well as the health status of farm animals (Oyawoye and Ogunkunle, 2004). As a result of the negative effect of the use of antibiotics in broiler production (Javandel *et al*., 2008), there is a need to utilize non-conventional growth enhancers in broiler nutrition that could improve nutrient digestibility, control pathogenic microorganisms, facilitate favourable intestinal microbial balance and enhance absorption of calorigenic nutrients across the gut wall by increasing its absorption capacity (Al- harthi, 2002; El-Deek *et al*., 2003). Feed ingredients gotten from plant materials that are of little or no value to man will be an advantage if used in broiler production.

The research work was undertaken to determine the effects of graded levels of Avocado Seed Meal on the carcass yield and haematological profile of broiler birds and to estimate the cost benefit effect of using Avocado Seed Meal in the diets.

Materials and methods

Experimental site

The experiment was carried out at the poultry unit of the University of Port Harcourt, Research and Demonstration Farm Choba, Rivers State. The campus is situated off east west road in Port-Harcourt, and is at latitude 4.89437°N, longitude 6.91053°E and 16m altitude, having an annual average temperature of 28°C (82.40°F). The experiment lasted for a period of eight weeks (56 days).

Experimental birds, design and management

A total number of one hundred and twenty (120), one day-old broiler birds of the cobb breed were used for the experiment. The experimental design was a Completely Randomized Design (CRD). The chicks were randomly assigned to four (4) treatment groups having 30 birds per group. Each treatment group was replicated three times with a total number of 10 birds per replicate. The four (4) treatment groups were designated as T_1, T_2, T_3 and T_4. The broiler birds were raised intensively using a deep litter system. Intensive management practices were adopted for this experiment.

Experimental diets

The avocado seeds were sourced from fruit sellers in Mile 1 market, Port Harcourt, Rivers State. The seeds were chopped with a kitchen knife and soaked in cold water for 24 hours to reduce the anti-nutritional factors present in the seed. The chopped seeds were sundried for a period of 7 days (4-5 hours a day). The dried seeds were ground into powdered form using a grinding machine to get the meal. The

avocado seed meal (ASM) was stored in an air tight container to avoid contamination. The meal was incorporated as an ingredient in the formulation of the broiler's feed at 0%, 0.5%, 1.0% and 1.5% dietary inclusion levels in both the starter and finisher phase.

Table 1: Experimental composition of broiler starter diet

Ingredients	**T1 (0%)**	**T2 (0.5%)**	**T3 (1.0%)**	**T4 (1.5%)**
Yellow maize	46.00	45.50	45.00	44.50
PKC	7.00	7.00	7.00	7.00
Soyabean meal	15.50	15.50	15.50	15.50
Groundnut cake	13.00	13.00	13.00	13.00
Fish meal	7.25	7.25	7.25	7.25
Wheat bran	4.50	4.50	4.50	4.50
Bone meal	3.00	3.00	3.00	3.00
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
Vitamin/mineral	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25
Avocado seed meal (ASM)	0.00	0.50	1.00	1.50
Total	**100**	**100**	**100**	**100**
Proximate analysis (%)				
Dry matter	90.94	90.75	90.76	90.75
Crude protein	18.38	17.50	18.38	16.63
Ash	20.22	17.62	20.08	15.78
Ether extract	2.26	2.14	2.12	2/04
Crude fibre	7.95	7.20	7.30	7.00
Nitrogen free Extract	42.13	46.29	42.88	49.34
ME (Kcal/kg)	2950	3000	3010	2990

Table 2: Experimental composition of broiler finisher diet

Ingredients	**T1 (0%)**	**T2 (0.5%)**	**T3 (1.0%)**	**T4 (1.5%)**
Yellow maize	47.50	47.00	46.50	46.00
PKC	8.50	8.50	8.50	8.50
Soyabean meal	14.25	14.25	14.25	14.25
Groundnut cake	11.00	11.00	11.00	11.00
Fish meal	6.50	6.50	6.50	6.50
Wheat bran	5.50	5.50	5.50	5.50
Bone meal	3.00	3.00	3.00	3.00
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
Vitamin/mineral	2.50	2.50	2.50	2.50
Salt	0.25	0.25	0.25	0.25
Avocado seed meal (ASM)	0.00	0.50	1.00	1.50
Total	**100**	**100**	**100**	**100**
Proximate analysis (%)				
Dry matter	90.70	90.72	90.75	90.70
Crude protein	18.38	17.00	16.21	15.75
Ash	18.16	19,01	20.50	22.10
Ether extract	2.87	2.93	3.04	3.13

Parameters measured

Carcass yield parameters

At the end of the experimental period (8 weeks), three broiler chickens were randomly selected from each replicate, starved for 12 hours, weighed, stunned and then slaughtered and allowed to bleed thoroughly. Thereafter, they were de-feathered, cleaned, dissected, and eviscerated. The different parts of the carcass were obtained and weighed.

Cost benefit analysis

The prices of the ingredients at the time of purchase were used to obtain the cost of feed per kg of the diet and also the cost of feed per 100kg of the diet (for both starter and finisher diet). These were later used to estimate other cost parameters.

Haematological parameters

At the end of the 56 days, blood was sampled from three birds per replicate and transferred into labeled and sterilized dry test tubes or bottles containing Ethylene Diamine Tetracetic Acid (EDTA) anticoagulant for haematological analysis which includes Packed Cell Volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), Platelets, Lymphocytes Neutrophils, Haemoglobin (Hb) and other blood indices (MCV, MCH).

Statistical analysis

The obtained data were analyzed using one-way Analysis of Variance (ANOVA). Where significant treatment effect was detected, means were separated using Ducan's multiple range test (DMRT) using the Statistical Package for Social Sciences (SPSS) software.

Results and discussion

Table 3 shows the effect of avocado seed meal on the carcass yield of broiler chickens (both starter and finisher phase). The live weight and carcass weight of the birds were not significantly different (P>0.05) across the various treatments group. The highest mean live weight of 1316.00 ± 142.40 g/bird was obtained in treatment 1 while the least value of 1106.67 ± 60.65 g/bird was obtained from birds fed treatment 4 diet (1.5% ASM). The live weight and carcass weight were not significantly (P>0.05) different which implied that elevation of dietary intake is not directly proportionate to nutrient value (Sese *et al.*, 2013). The relative weights of the carcass components obtained also showed no significant difference (P>0.05) across the various treatments.

Table 3: Effect of avocado seed meal on carcass yield of broilers

Carcass parameters	T_1 (0% ASM)	T_2 (0.5% ASM)	T_3 (1.0% ASM)	T_4 (1.5% ASM)
Live weight (g)	1316.00 ± 142.40	1263.33 ± 144.38	1203.33 ± 176.16	1106.67 ± 60.65
Dressed carcass weight (g)	1165.33 ± 120.42	1127.67 ± 104.92	1087.20 ± 108.84	968.33 ± 58.62
Shank (g)	57.67 ± 6.84	58.67 ± 5.24	51.00 ± 2.08	48.00 ± 7.57
Neck (g)	65.07 ± 9.60	65.67 ± 3.84	61.33 ± 7.45	48.33 ± 3.76
Wings (g)	94.00 ± 12.42	102.33 ± 7.84	92.00 ± 10.02	76.00 ± 5.51
Drumsticks (g)	115.33 ± 16.37	118.33 ± 8.67	114.33 ± 14.40	82.67 ± 14.25
Thighs (g)	132.67 ± 19.65	141.33 ± 5.61	134.67 ± 17.70	101.33 ± 12.12
Breast (g)	208.00 ± 36.39	201.00 ± 13.23	197.33 ± 36.41	170.67 ± 9.94
Back (g)	196.33 ± 18.37	204.67 ± 18.89	184.67 ± 32.26	137.00 ± 7.23

Means in a row with no superscript are not significantly different (P>0.05).

Table 4 shows the cost benefit analysis of the experimental diets. The result showed no significant difference (P>0.05) in the feed cost per kilogram between the treatments. Although there was a slight reduction in the feed cost/kg with increasing levels of avocado seed meal in the diet. When ASM was used up to 1.5% the feed cost/kg decreased from N309.30/kg to N308.30/kg. The observed slight decline in the feed cost/kg from N309.30/kg to N308.30/kg might be due to the fact that the avocado seed is considered as a by-product of the fruit (waste) and generally not utilized (Ejiofor *et al.,* 2018). The cost of feed consumed/animal, cost of feed/kg weight gain and mortality also showed no significant difference (P>0.05) across the various treatments.

Table 4: Cost benefit analysis of feeding avocado seed meal to broiler chickens

Parameters	T_1 (0% ASM)	T_2 (0.5% ASM)	T_3 (1.0% ASM)	T_4 (1.5% ASM)
Feed cost(₦/kg)	309.30 ± 1.16	308.80 ± 1.16	308.50 ± 1.16	308.30 ± 1.16
Cost of feed consumed (₦/bird)	73.99 ± 16.31	72.12 ± 16.03	73.03 ± 15.75	72.00 ± 16.05
Feed cost per weight gain (₦/kg)	249.86 ± 27.32	231.53 ± 17.90	228.11 ± 19.86	218.43 ± 14.59
Mortality (%)	0.83 ± 1.15	1.16 ± 1.15	0.83 ± 1.15	1.16 ± 1.15

Means in a row with no superscript are not significantly different (P>0.05).

Table 5 shows effect of Avocado Seed meal on the haematological profile of broiler birds. The WBC, platelets, neutrophils and lymphocytes were significantly different (P<0.05) between the treatment groups, while the Packed Cell Volume (PCV), Haemoglobin, Red Blood Cell (RBC), MCV and MCH were not significantly different (P>0.05) among the various treatments. The white blood cells were significantly higher in treatment 3 (15.33×10^9/L) than treatment 4 (13.27×10^9/L) followed by treatment 2 (13.10×10^9/L). Birds in the control diet recorded the lowest white blood cell mean value. The increase in white blood cells value as the level of avocado seed meal increased in the diet agreed with the findings of Fadlalla *et al.* (2010) on significant increase in the total white blood cell counts of birds fed graded levels of garlic powder. The increase in the white blood cell count could be due to the presence of some bioactive phenolic compound in avocado seed that showed antimicrobial, antiviral and antitumor activities (Ejiofor *et al.*, 2018).

Table 5: Effect of avocado seed meal on haematological profile of broilers

Haematological parameters	T_1 (0% ASM)	T_2 (0.5% ASM)	T_3 (1.0% ASM)	T_4 (1.5% ASM)
Packed cell volume	30.00 ± 1.73	27.33 ± 0.67	27.67 ± 1.45	28.33 ± 1.20
Haemoglobin	10.00 ± 0.58	9.10 ± 0.20	9.20 ± 0.49	9.47 ± 0.39
Red blood cells	4.43 ± 0.23	4.07 ± 0.15	4.07 ± 0.30	4.23 ± 0.23
White blood cells	11.63^{b} ± 1.10	13.10^{ab} ± 1.07	15.33^{a} ± 0.73	13.27^{ab} ± 0.47
Mean cell volume	67.67 ± 0.61	67.30 ±h 1.10	68.27 ± 1.57	67.00 ± 0.95
Mean corpuscular haemoglobin	22.53 ± 0.20	22.40 ± 0.40	22.67 ± 0.52	22.40 ± 0.36
Platelets	209.00^{b} ± 9.54	248.67^{ab} ± 11.29	252.33^{ab} ± 16.90	256.00^{a} ± 14.30
Neutrophils	27.67^{c} ± 1.45	41.00^{a} ± 2.08	32.67^{bc} ± 1.76	37.67^{ab} ± 1.45
Lymphocytes	60.67^{a} ± 0.67	46.67^{c} ± 1.67	55.00^{ab} ± 2.89	50.00^{bc} ± 2.89

^{abc}, means on the same rows having different superscript differ significantly (P<0.05)

A progressive increment (P<0.05) in the platelet level was observed in treatment 3 and 4 having 252.33% and 256.00%, respectively followed by treatment 2 (248.67%) and treatment 1 (209.00%). Neutrophils value observed in the result were significantly (P<0.05) higher in treatment 2 (41.00%), 4 (37.67%) and 3 (32.67%) over the control treatment (27.67%). This agreed with the findings of Al-khalifa *et al.* (2018) who reported a significant increase in the neutrophils percentage of broilers fed graded levels of ginger powder. The increase in the neutrophils might be an indication that birds fed with the various ASM diets may be under stress, infection or inflammation (Veitinghoft and Ley, 2008). Duncan *et al.* (1994), also reported that higher levels of neutrophils in chickens might be attributed to excitement which can cause an epinephrine release that can result to neutrophilia and sometimes lymphocytosis in animals. The lymphocyte profile was significantly higher in treatment 1 (60.67%) than the other treatments.

Conclusions

The present study shows that broilers can be fed up to 1.5% inclusion of Avocado seed meal in their diet, as it did not have any deleterious effects, but rather beneficial effects on the haematological status of broiler birds, since the White Blood Cell, PCV, Lymphocytes, Neutrophils, MCV and MCH were within the normal haematological reference range.

Results from the cost analysis indicates that the use of ASM as an ingredient in broiler feed will lead to the production of healthy birds at a reduced cost which will go a long way in proffering solutions to low protein supply facing Nigeria.

The inclusion of 0.5% to 1.5% (5g to 15g/kg of feed) of avocado seed meal as a feed ingredient to the diets of broiler chickens is recommended due to its enhanced effect on the haematological parameters of broiler birds.

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