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EFFECT OF PAWPAW (CARRICA PAPAYA) SEED OIL INCLUSION ON CARCASS CHARACTERISTICS AND HAEMATO-BIOCHEMOICAL INDICES OF BROILER CHICKENS

Bamigboye Samson. O*, Aduragbemi Yetunde Adesina, Oluchi Jecinta Eleleh
Department of Animal Science, University of Abuja, Abuja, Nigeria.
Corresponding author: Bamigboye Samson. O, Email: bosam4deco@gmail.com

Abstract: This experiment was aimed to evaluate the effect of broiler chickens fed diets containing pawpaw (carrica papaya) seed oil (PSO) as a feed addictive on Carcass quality and haemato-biochemoical indices of broiler Chickens. A total of 195 day-old Arbor Acre were used, Five experimental diets each were formulated during the starter (1-28days) and finisher (29-58days) phases such that the basal diets were addictive with 0, 0.1, 0.2, 0.3 and 0.4% PSO respectively. These chicks were randomly allocated to the five dietary treatments comprising of three replicates each in a completely randomized design. At day 58, three (3) birds per treatment were randomly selected for slaughter in order to measure carcass cut-up parts (thigh, breast, neck, wing, back, drumstick and abdominal fat), and selected organs were weighed and expressed relative to live weight. The immunity index was also evaluated. Pack cell volume, red blood cell, haemoglobin, means corpuscular haemoglobin concentration, white blood cell, lymphocytes and monocyte values were significantly ($P<0.05$) different among the group. There was no particular trend in the mortality pattern across the treatments. In conclusion, it was conclusion, dietary supplementation of PSO up to 0.4ml in the diet of broiler without causing any deleterious effect on their performance and health status.
Keywords: Carica papaya oil; Haemato-biochemoical; Carcass; Broiler; Diet

1 INTRODUCTION

The seed of papaya has antimicrobial activity against *Trichomonas vaginalis* trophozoites. Its seeds also have contraceptive effects in adult male Langur Monkeys, possibly in adult male humans [1, 2]. It could also be used in urinogenital disorder like trichomoniasis with care to avoid toxicity [3]. The seeds, irrespective of its fruit maturity stages have bacteriostatic activity on gram positive and negative organisms which could be useful in treating chronic skin ulcer. The papaya seed macerate has a clinical potential on conjugal R plasmid transfer from *Salmonella typhimurium*to *Escherichia coli in vitro* and in the digestive tract of gnotobiotic mice [4]. The seed being consumed offers a cheap, natural, harmless, readily available mono therapy and preventive strategy against intestinal Parasitosis .
The composition of these seeds, compiled by Marfo and Puangsri, revealed that they are a rich source of protein (27.3-28.3%), lipids (28.2-30.7%) and crude fibres (19.1-22.6%). Marfo found appreciable quantities of calcium and phosphorous in the seeds. Oleic, palmitic, linoleic, and stearic acids were the most abundant fatty acids found in the papaya seed oil. Masson determined the fatty acid composition and bioactive compounds of the oil extracted from seeds of papaya. Oil extraction from papaya seeds may add economic value to a large quantity of seeds that are generally discarded.
Although, positive results have been reported when pawpaw plant parts are used as supplements or ingredients in animal feed [5], pathological investigations on effects of the use of pawpaw seeds oil as dietary supplements or ingredients on broiler chickens are very few.

2 MATERIALS AND METHODS

This study was conducted at the Department of Animal Science, Faculty of Agriculture, university of Abuja teaching and research farm, main campus, along Airport road, Gwagwalada, Abuja. Gwagwalada is one of the six (6) area councils of the Federal Capital Territory of Nigeria. It lies between latitude 08°51 and 09°37N and longitude of 007°20 and 007°51 E and the land mass covers 65sq km.

3 PAPAYA SEED OIL EXTRACTION

The papaya seed was procured from the local market within Gwagwalada market Abuja (Nigeria).
Pawpaw seed oil was extracted using steam distillation technique. Steam distillation procedure requires: a digital weighing scale, round bottom flask, distilled water.
50grams of grinded pawpaw seed was weighed into a round bottom flask mixed with 250ml of distilled water. The condenser was set up above the flask with a circular bottom after the mixture was transferred to a glass yarn heating mantle

and heated to a temperature of 80^0C. The mixture is boiled vigorously for a period of 15minutes, after which the distillate is gathered in a beaker until no more oil drips are visible, and then it is poured into a separatory funnel to yield pawpaw seed essential oil.

4 DESIGN AND MANAGEMENTS OF EXPERIMENTAL BIRDS

One hundred and Ninety-five (195) day old white marshal broiler starter chicks was purchased from a reputable hatchery. The chicks on arrival at the experiment site were housed in battery cage with twine mesh at the base for easy collection of faeces. The cage was disinfected and cleared a week before the birds arrived. At arrival, the birds were given anti-stress with antibiotics for the first week and were allowed them to adapt to the environment. Feeders and drinkers were provided. The performance of the chicks was monitor and the initial weights of the chick were recorded at the commencement of the experiment. Weekly body weight gained and weekly feed intake record was taken.
All data was subjected to Complete Randomized Design (CRD) model by Steel and Torrie. The significant difference between mean was compared using Duncan Multiple Range test. The birds was weighed and randomly allotted into five (5) treatments with three (3) replicates per treatments in a completely randomized design. Each replicate contained thirteen (13) birds making 39birds per treatment. Heat and light was provided throughout the experimental period using kerosene lantern, electricity. Feed and water was provided ad-libitum and the experiment will last for a period of 56days. Routine vaccination and other medications was administered at when due.

5 EXPERIMENTAL DESIGN AND DIET

Diets 1 was formulated to meet the nutrient requirement for broilers according to Aduku, 1994 as presented in Table 1. Experimental diet at the starter phase (1-28th days) and finisher phase (29-56th days) was contained 23.30% crude protein and 21.40% crude protein respectively.
The experimental set up is shown below:
Diet 1: Basal diet without synthetic antibiotics and pawpaw seed oil
Diet 2: Basal diet + 0.1ml
Diet 3: Basal diet + 0.2ml
Diet 4: Basal diet + 0.3ml
Diet 5: Basal diet +0.4ml

6 DATA COLLECTION

6.1 Carcass Evaluation

On day 56 of the experiment, (3) three birds per replicate were selected for carcass evaluation. The birds were weighed and their jugular vein was cut with clean, sharp stainless knife. The slaughter birds were de-feathered, eviscerated, and dress. The dressed weight of the visceral and the cut part will be recorded. Thereafter, the liver, heart, lung, bile, gizzard, spleen and bursa will excised out with a clean surgical blade, blotted with tissue paper, weighed and expressed as the percentage of slaughtered weight.

6.2 Blood analysis

At the end of the experiment blood samples were collected early in the morning from 15 broiler chickens, (3 birds per treatments) selected randomly per replicate for heamatological and serum analysis, the animals were not stressed to prevent oxygenated blood from becoming deoxygenated. At the end of the trial, 2mL of blood was collected from the wing web of 3 randomly selected birds per group. Blood samples for haematology (2mL) was collected into a sterile labeled bottles with anticoagulant (ethylene diamine tetraacetic acid) and kept in an ice pack before it was taken to the laboratory.
Haematological parameters were analyzed using 5- part Auto haematology analyzer (Model: BK-6310) which work based on the principle of triangle laser scatter, flow cytometry method, 3D scatter gram analysis, impedence method for red blood cell count. For efficiency in performance, white blood cell and haemoglobin count are adjusted at a linearity range of 300 × 109/L-1 and 250 × 109/L-1 respectively.

6.3 Statistical analysis

All data collected was subjected to one-way analysis of variance (ANOVA) using SPSS (25.0) and significant means will be separated using Duncan multiple range tests [6] significant will be declared if $P \leq 0.05$.

Table 1 Ingredient Composition of the Experimental Diets

Ingredients	**Starter**	**Finisher**
Maize	52.00	60.00
Wheat offal	2.50	5.00
Soya bean meal	30.00	25.00
Groundnut cake	8.00	4.00
Fish meal	2.00	2.00
Limestone	1.50	1.50
Bone meal	3.00	3.00
Lysine	0.20	0.20
Methionine	0.20	0.20
Premix	0.25	0.25
Salt	0.30	0.30
Toxin binder	0.10	0.10
Total	**100**	**100**
Determined analysis (% DM)		
Crude protein	23.30	21.40
Crude fibre	4.18	5.01
Ether extract	4.03	4.47
Calcium	1.50	1.60
Phosphorus	0.58	0.66
Energy (Kcal/kg)	2900.3	3200.8

7 RESULTS

Table 2 Carcass Characteristics of Broiler Chickens Fed PSO

Parameters%	T1	T2	T3	T4	T5	SEM
Live weight (g)	1604.3^{c}	1870.6^{b}	1970.1^{b}	2201.8^{a}	2400.2^{a}	12.31
Dress weight (g)	1384.3^{c}	15420.2^{b}	1649.0^{b}	1810.7^{a}	2200.3^{a}	18.35
Dressed weight	76.40^{c}	77.00^{c}	78.63^{b}	81.4^{a}	85.2^{a}	0.18
Thigh	9.45^{c}	11.22^{b}	11.34^{b}	11.36^{a}	11.40^{a}	1.42
Drum stick	10.88^{b}	10.21^{b}	10.08^{b}	13.49^{a}	15.50^{a}	0.97
Breast cut	17.12^{c}	19.25^{b}	22.08^{a}	23.17^{a}	24.18^{b}	2.04
Back cut	19.22^{b}	18.45^{b}	19.21^{b}	22.17^{a}	23.21^{a}	1.93
Wing	11.22^{a}	10.88^{a}	8.77^{b}	9.92^{b}	10.2^{b}	0.05
Heart	0.94^{b}	0.91^{b}	0.77^{c}	1.16^{a}	1.18^{b}	0.02
Liver	2.39^{a}	2.44^{a}	1.78^{b}	2.08^{a}	2.12^{a}	0.01

Kidney	0.78[b]	1.12[a]	1.08[a]	1.18[a]	1.26[a]	0.18
Spleen	0.10[b]	0.18[a]	0.16[a]	0.17[a]	0.19[a]	0.09
Gizzard	6.49[a]	5.08[b]	5.88[b]	6.03[a]	6.05[a]	1.01
Proventriculus	1.44[a]	0.94[b]	1.34[a]	1.28[a]	1.32[a]	0.05

Table 2 Shows the results of effect of graded levels of pawpaw seed oil on the carcass characteristics of broilers is presented in Table 2. There were significant (P<0.05) differences in the live weight, dressed weight, percentages of wings, back. Heart, kidney, gizzard and abdominal fat. There were no significant differences (P>0.05) in the dressing percentage, percentages of the breast, drum stick and length of the intestine.

Table 3 Effect of Pawpaw Seed Oil on the Haemato-Biochemoical Indices of Broiler Chickens Fed the Experimental Diets

Parameters	T1	T2	T3	T4	T5	SEM
PCV (%)	27.54[b]	30.31[a]	32.48[a]	33.15[a]	34.02[a]	0.48
RBC (x10^6/µL)	2.50[b]	2.15[b]	2.53[b]	3.02[a]	3.18[a]	3.07
Haemoglobin (g/dL)	10.17[d]	11.38[c]	12.03[b]	13.02[a]	14.16[a]	2.21
MCH (Pg)	60.82[c]	60.46[b]	69.36[b]	78.50[b]	90.61[a]	3.45
MCV (fl)	79.08[c]	88.67[c]	98.44[b]	140.26[a]	150.03[a]	1.64
MCHC (g/dL)	50.66[b]	55.37[b]	55.39[b]	60.78[a]	60.48[a]	2.05
WBC (x10^3/µL)	16.72[c]	23.85[b]	25.70[b]	28.50[b]	30.19[a]	0.67
Monocyte (x10^3/µL)	0.66[c]	2.05[a]	2.06[a]	2.25[a]	2.15[a]	0.06
Lymphocytes (x10^3/µL)	13.17[d]	16.18[c]	18.43[b]	20.20[a]	21.20[a]	1.60

Mean in the same row with different superscripts are significantly different (P<0.05).
MCH: mean corpuscular hemoglobin: MCV: mean corpuscular volume: MCHC: mean corpuscular haemoglobin concentration: WBC: white blood cell: Monocyte: Lymphocytes.

Table 3 shows the Haematological parameters of dietary inclusion of pawpaw seed oil on broiler chicken. Pack cell volume, red blood cell, haemoglobin, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration and white blood cell of birds fed diets supplemented with PSO at 0.1ml (group 2) were similar ($P > 0.05$) to those fed diet without PSO (group 1). Similarly, birds fed 0.3ml PSO (group 4) were also similar ($P > 0.05$) to those in group 5 (0.4ml). However, those in group 4 and 5 values were significantly higher ($P < 0.05$) than the other groups. Lymphocytes and monocytes values were higher in group 4 and 5 compared to the other groups.

8 DISCUSSION

Several phytoactive compounds from PSO are attributed to important biological activities [7-9]. These phyto-constituents have several pharmacological or therapeutic properties [10]. They are also generally recognized as safe, effective and environmentally friendly which make them good candidates to be used as feed additives in poultry production in comparison with antibiotics [11,12].

The biological mechanism of action of phytochemicals depends on their chemical structure [13,14]. Phytochemicals used in animals have many functions including being antioxidant, anti-estrogenic, anti-inflammatory, immunomodulatory and anti-carcinogenic [15,16]. For instance, saponins belong to a group of phytochemicals that serves as one of the major defense systems for plants against microbial, fungal, and insect attack [17]. They can be found in most plant species although the amount and the concentration of saponins in plants varies from species to species [18]. Saponins act by forming complexes with sterols or polysaccharides within the microbial cell membrane so destroying the cytoplasmic membrane integrity [17].The result suggests that phytochemicals in PSO can improve animal's health and performance because of their anti-microbial, anti-stress [19] and antioxidant properties, and their ability to modulate gut microbiota [20] and enhance immune responses [21,22].

The efficiency of these phytochemicals is determined by intrinsic and extrinsic factors such as animal's nutrition and health, type of diet and environment [23,24]. Supplementation of PSO at 0.3ml (group 4) and 0.4ml (group 5) can effectively

inhibit the activities of pathogenic organisms, improve palatability and promote the activities of intestinal enzymes, thus positively influencing the digestion and absorption of nutrients, reduce the digester transit time and the increase feed conversion efficiency in birds [25]. The result on the overall mortality rate reveals that supplementing PSO can increase the survivability of birds due to the presence of phyto-constituents or bioactive compounds in them. This explains why mortality was recorded only among birds in group 1 with no PSO.

The pack cell volume, red blood cell and haemoglobin values were within the normal ranges (23.0-35.0%), 2.00-5.00 ($\times 10^6$/L) and 8.00-15.00 g/dL reported by Akpabio& Offiong [26]. Decrease in pack cell volume suggests the presence of anaemia or mineral and vitamin deficiency [27]. Low red blood cell and haemoglobin concentrations is an indication of bone marrow disorder, kidney failure and iron deficiency [28,29]. Haemoglobins are conjugated protein that transports oxygen from lungs to tissues and carbon dioxide from tissues to the lungs [30].

Improved pack cell volume, red blood cell and heamoglobin concentration among birds in group 4 (0.3ml PSO) and group 5 (0.4 PSO) suggests the efficient distribution of oxygen and other nutrients in the body of birds [31]. Mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentrations values obtained in this study were within the established range (78.00-151.0 fl), 59.00-92.00 pg and 49.00-62.00 g/dL-1 reported in Merck Veterinary Manual [32]. Values recorded were lower than those reported cited by Jain [27], this variation can be attributed to age of birds, breeds, nutrition and management procedures for the animals [30].

White blood cells are important part of the body's immune defense system that are involved in protecting the body against both infectious diseases and foreign invaders through the production of antibodies [33,34]. White blood cell values recorded in this experiment was within the normal range 15.00-32.00 ($\times 10^3$) reported by Islam *et al*., [35]. The fundamental role of lymphocytes and monocytes is to perform immune-modulatory activities in animals [36].

9 CONCLUSION

Five experiments were conducted to determine the best level of pawpaw seed oil inclusion in broiler diets with 0.1ml, 0.2ml, 0.3ml and 0.4ml inclusion level. 0.4ml pawpaw seed oil inclusion level compared farvourably with highest growth rate and *Caricca papaya* essential oil is nutritionally non-toxic and safe without affecting their performance and health condition. The best graded level of pawpaw seed oil inclusion that gave optimum performance was at 0.4ml inclusion rate.

10 RECOMMENDATION

Farms may include 0.4% Pawpaw seed oil inclusion in both starter and finisher diets since it support optimal performance and compared farvourably with conventional antibiotics. Further studies' using different inclusion levels and calculating cost implication is recommended.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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