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Evaluation of varying levels of *Carica papaya* leaf meal on growth, carcass, hematological parameters and its use as anticoccidial for broiler chicken

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Abstract

Medicinal plants have been traditionally used for treatments of various diseases in many countries. Carica papaya is one of potential feed supplements which have recently been reported as having a wide range of beneficial effects on production performance. A seven weeks trial was conducted to investigate the effect of graded levels of C. papaya leaf meal on broiler growth performance, carcass characteristics, hematological parameters and its anticoccidial properties. A total of one hundred and fifty day-old Marshal broiler chicks were randomly allotted to five dietary treatments with 30 birds per treatment, replicated thrice in a completely randomized design. The treatments were; diet with coccidiostat as a positive control (T1), diet without C. papaya leaf meal nor coccidiostat (T2), diet with 200 g of C. papaya leaf meal/100kg of feed (T3), diet with 400 g C. papaya leaf meal/100kg of feed (T4), and diet with 600 g of C. papaya leaf meal/100kg of feed (T5). The phytochemical component of the C. papaya leaf meal varied from positive to strongly positive. Significant differences (P<0.05) were observed in the final weight, feed intake and the mortality percentage. The best liveability and final weight gain were obtained from the birds fed diets with 400 g of C. papaya leaf meal while non significance differences were observed on the carcass characteristics except on the live weight. The blood profiles were within the normal levels. It can be concluded that C. papaya leaf meal can be used at the rate of 400 g/100kg of feed for broiler chicken without any deleterious effect on the performance and carcass characteristics.

***Keywords:** Carica papaya, performance, coccidiostat, phytochemical, carcass, hematological.*

Description of Problem

In the recent past, antibiotics were regularly used in feed as additives, but currently, use of antibiotics in animal feed is not only restricted but also the practice of using antibiotics in livestock and poultry industry have been prohibited in many countries due to their ability modify natural gut microbiota and build drug resistance in microorganisms and human (1).Medicinal plants have been used in poultry production because they perform many functions including: stimulation of appetite and feed intake, the enhancement of endogenous digestive enzyme secretion, stimulation of immune responses and antibacterial, antiviral and antioxidant actions (2,3). There is need to achieve food security and self-sufficiency in animal protein supply in a rapidly increasing population, in Africa and indeed the world, this calls for increased production of meat animals, notably poultry, which are currently produced at subsistence level. Herbs and natural products are cheaper and can be used as alternative feed additives to enhance performance of poultry birds because they are readily available. These readily available medicinal plants are a good source of potent bioactive compounds that are used for therapeutic treatment or as precursors in the making of synthetic drugs (4).

Poultry production profitability is reduced by internal parasites, such as coccidia, which is one of the most common poultry infections, and causes major economic losses worldwide (5, 6). Coccidiosis is an important factor and plays an inhibitory role in the growth of poultry industry. Coccidiosis is caused by different species of *Eimeria* which infect birds and inflict the birds in both clinical and sub-clinical forms (7). The clinical form of the disease manifests through prominent signs like bloody faeces, diarrhea, morbidity and finally mortality. The subclinical coccidiosis manifests mainly by poor weight gain and reduced feed efficiency which in turns gives rise to higher economic losses (8, 9). The use routinely of anti-coccidia drugs has led to strains of parasites which are resistant to drugs (10) and on the other hand, prejudicial to consumer health because of drug or antibiotic residue in poultry products (11). The emergence of drug resistant strains of coccidia has made currently available anti-coccidial drugs less effective and this has threatened the survival of the poultry industry, especially in developing countries where the problem has become a major problem for poultry farmers. More recently, there have been lots of interests in many countries on the collection, collation and use of medicinal plants and their extract (12).

Carica papaya is a plant belonging to family Caricaceae. It also has common names such as pawpaw and papaya, with potential medicinal values and has been cultivated in most tropical countries (13). FAO, (14) reported that Nigeria a country in tropical Africa that produces about 836, 702 metric tons is considered the 6th largest producer of pawpaw globally after India, Brazil, Mexico, Indonesia, Dominican Republic. *Carica papaya* is a large herbaceous tree-like perennial plant with a soft stem that can grow to a height ranging from 5meters to10meters in height, depending on the variety. The leaves are sparely arranged from mid-way of the stem to the top of the trunk depending on the variety. For many years, nature has given us a source of medicinal plants, in which all parts of plants such as leaves, fruits, seeds, peel, roots, flowers are used (15,16). The pawpaw tree contains the enzyme papain and chymopapain, these two enzymes are biologically active and they both have medicinal and nutritional values. This plant has medicinal and therapeutic uses; they can be used as anti-amoebic, anti-fertility activity, anti-microbial, anti-ulcerogenic, antitumor, anti-fungal, hypolipidaemic and employed in wound-healing activity, free radical scavenging activity, diuretic activity, uterotonic activity (17, 18). The leaves of pawpaw while young are rich in alkaloids flavonoids, phenolic compounds, the cytogenetic compounds (19). The phytogenic and nutritive potentials of the papaya leaf could be used as an additive in feed as a growth promoter in broiler chicken.

However, studies have shown that resistance to anticoccidial drugs develops with time (20), this therefore necessitate for treatments that is effective and cheaper to the farmer. The use of medicinal plant extracts in the treatment of both human and animal diseases is gaining popularity because it is affordable by farmers in developing countries (21). According to the World Health Organization (WHO), about 80 to 90% of the world's population still relies on traditional medicine for their health care needs (22). Since the ultimate goal of a farmer is to maximize profits, many farmers go for the cheapest and easiest means of fighting diseases such as coccidiosis. Every practical effort should be made to reduce mortality rate in poultry, an unexplained death should be regarded with concern, as it may point to the presence of a serious disease (23).Different medicinal plants have been investigated for controlling this menace. The objective of the study is to evaluate the effects of varying levels of *C. papaya* leaf meal on, carcass, growth hematological parameters and its use as anticoccidial for broiler chicken.

Materials and Methods

Experimental site: The experiment was carried out at the poultry unit of Federal College of Animal Health and Production Technology, Moor Plantation, Bora Ibadan, Nigeria.

Sourcing and Processing of Test Ingredients: Fresh pawpaw leaves (*Carica papaya*) that were previously identified by a botanist were harvested at about 6.00 am from the farm premises. The Pawpaw leaves were separated from the stalk, chopped into smaller pieces, and air-dried for 7 days on a clean concrete floor. By the 7th day, they had become crispy and had a constant weight. The leaves were hammer milled and kept in an airtight container. This was later used in ration formulation with other ingredients sourced from a local feed miller.

Experimental Designs and Birds: One hundred and fifty day-old Marshal broiler chicks were purchased and allotted into five dietary treatments: T1, T2, T3, T4 and T5 with 30 birds per treatment and replicated thrice using a completely randomized design (CRD). Commercial starter diet was served to the birds for the first week, thereafter, experimental starter diet was served to the birds from the second week to fourth week and finisher diet from fourth week to eight week` with inclusion of *C. papaya* (pawpaw leaf) and coccidiostat as follows: T1- Positive control, were naturally infected and treated under normal farm condition with the use of coccidiostat (Embazin forte). T2- Negative control, were naturally infected but not treated with coccidiostat nor fed with diet containing *C. papaya* leaf meal, T3- They were naturally infected and fed with diet containing 200 g *C. papaya*/100 kg of feed. T4- They were naturally infected and fed with diet containing 400 g *C. papaya*/100 kg of feed. T5- They were naturally infected and fed with diet containing 600 g of *C. papaya*/100 kg of feed).

Experimental Birds and their Management: Broiler chicks (Marshal Strain) were purchased from a reputable hatchery in Ibadan. Initial weights of the birds were taken with the use of sensitive weighing scale before they were transferred into well disinfected brooding house. Experimental feed and clean cool water were provided *ad-libitum* throughout the period of the experiment. Vaccines and medication were administered as at when due.

Source and Process of Natural Infection on Experimental Birds: Infected beddings of birds with coccidiosis were gotten from a farm that had an outbreak of coccidiosis. The litter was packed and samples taken to the laboratory to confirm the presence of *Eimeria* oocytes through fecal parasite screening. Screening was done with the use of sodium chloride by flotation method (24). When coccidiosis infection was confirmed positive, equal quantity of litter were evenly broadcasted on the floor in each replicate as bedding which lasted for a week and later cleared when the birds started manifesting signs and symptoms of coccidiosis.

Proximate and Phytochemical Analysis: The formulated diets with pawpaw leaf meal were analyzed for proximate composition using an AOAC method (25). The air-dried sample of the pawpaw leaf meal was taken to the lab for phytochemical analysis, to determine the presence of phytate, saponin, flavonoid, tannin and alkaloid while the quantification of saponin was done by afrosimetric method (26). The gravimetric method (27) was used in determination of alkaloid and flavonoid contents. All the analyses were done in triplicate.

Data Collection: Initial weights of birds were taken before they were disseminated into various treatments at a week old. Experimental diet containing *C. papaya* was served over a 7-week period. Final weights were determined using a sensitive weighing scale. Feed intake (g) is the daily feed consumed which was obtained by deducting the weight of remnant feed from the feed offered the previous day over a period of 7weeks; the total feed intake was calculated. Body weight gain (g) was done on weekly basis. It was obtained by deducting the previous week's body weight from the subsequent week's body weight. The feed conversion ratio was calculated, while the mortality rate was recorded as they occur.

Table 1: Gross Composition of Experimental Broiler Starter Diets (%)

Ingredient (Kg)	T1	T2	T3(200g)	T4(400g)	T5(600g)
Maize	50.00	50.00	50.00	50.00	50.00
C. papaya	-	-	0.20	0.40	0.60
Soya-bean meal	30.00	30.00	30.00	30.00	30.00
Wheat offal	11.00	11.00	11.00	11.00	11.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	4.30	4.30	4.30	4.30	4.30
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Determined analysis					
Crude Protein (%)	22.46	22.46	22.48	22.50	22.53
Crude Fiber (%)	4.00	4.00	4.05	4.08	4.13
Ether extract (%)	4.00	4.00	4.01	4.01	4.05
Metabolizable energy (Kcal/kg)	2847.10	2847.10	2847.10	2847.10	2847.10

Determination of coccidia infection: At day 10 of post infection, five grams of fecal sample were randomly collected along the five treatments (T1, T2 T3, T4, and T5) and each was placed in labelled universal bottle, the presence of oocytes was determined in the laboratory through faecal parasite screening, with the use of sodium chloride using flotation method according to (24).

Carcass Evaluation: At the end of the experiment, the birds were fasted overnight; two birds were randomly selected from each replicate and weighed the following morning prior to slaughtering. Birds were slaughtered by using sharp knife on the jugular vein according to (28). Birds were defeathered, eviscerated and the respective weights were taken. The live, plucked, eviscerated, dressed, breast, drumstick and thigh weight, were taken. Organs measured were gizzard, liver and the heart.

Blood collection and hematological analysis: After seven weeks of feeding trials, two birds from each dietary replicate were randomly sampled to determine hematological responses. 5 ml of blood was taken from the jugular vein of randomly selected birds per replicate. Sampled blood measuring 2.5 ml was put into labeled blood sample bottles containing anti-coagulant (Ethyl Diamine-Tetra-Acetate powder (EDTA)) and taken to the laboratory to determine hematological parameters. Parameters determined include; Packed Cell Volume (PCV)(%), Haemoglobin concentration (g/l), Red Blood Cells count (RBC)(10^{12}ul), White Blood Cell count (WBC)(10^{12}ul), Platelets (µL)**,** Lymphocytes (%), Neutrophils (%), Monocytes (%), Eosinophil (%) and Basophils (%) according to the procedure of (29).

Statistical Analysis: Data collected were subjected to analysis of variance (ANOVA) according to the procedure of (30). Statistically significantly different treatments means were separated using Duncan multiple range test (31).

Table 2: Gross Composition of Experimental Broiler Finisher Diets (%)

Ingredient (Kg) ((Kg) ((%	**T1**	**T2**	**T3(200g)**	**T4(400g)**	**T5(600g)**
Maize	55.88	55.88	55.88	55.88	55.88
C. papaya -	-	0.20	0.40	0.60	
Soya-bean meal	24.42	24.42	24.42	24.42	24.42
Wheat offal 13.00	13.00	13.00	13.00	13.00	
Fish meal 3.00	3.00	3.00	3.00	3.00	
Bone meal 3.00	3.00	3.00	3.00	3.00	
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine 0.10	0.10	0.10	0.10	0.10	
Salt 0.25	0.25	0.25	0.25	0.25	
Premix 0.25	0.25	0.25	0.25	0.25	
TOTAL	100.00	100.00	100.00	100.00	100.00
Determined analysis					
Crude Protein (%)	20.00	20.00	20.04	20.06	20.10
Crude Fiber (%)	4.00	4.00	4.00	4.02	4.05
Ether extract (%)	4.00	4.00	4.00	4.00	4.00
Metabolizable energy (Kcal/kg)	2700	2700	2700	2700	2700

Results and Discussion

Tables 1 and 2 shows the proximate composition of the experimental broiler starter and finisher diets. The starter and finisher diets are both iso-caloric and iso-nitrogenous. They both fell within the range recommended by (32) for broiler production. Table 3 shows the qualitative and quantitative result of the phytochemical constituents of C. *papaya* leaf meal. The results showed the presence of tannin (0.341), phenol (0.265), alkaloids (0.423), saponin (0.575), flavonoids (0.372), terpenes (0.217), steroids (0,127), trypsin inhibitor (0.242), glycoside (0.351), oxalate (0.251), and phytate (0.212) all per 100g *of C. papaya* leaf meal.

Table 3: Phytochemical Constituents of *Carica papaya* meal leaf

Parameters Determined mg/100g	Qualitative	Quantitative mean
Tannin	++	0.345
Phenol	++	0.265
Saponin	+++	0.424
Alkaloids	++	0.575
Flavonoids	+	0.373
Terpenes	+	0.217
Steroids	++	0.173
Trypsin inhibitor	++	0.243
Glycosides	++	0.366
Oxalates	+	0.252
Phytate	+	0.212

+positive ++ moderately present +++ strongly positive

The oocyst count of broiler chicken fed diets containing varying levels of *C. papaya* leaf meal is as shown in table 4. At the onset, all treatments had almost the same level of oocyst count. But the final count indicates that with the inclusion of *C. papaya* in the diets, significant differences was observed among treatments, with T1 having the lowest count while T2 had the highest oocyst count.

Table 4: Oocyst count of broiler chicken fed diet containing varying levels of *C. papaya* leaf meal

Parameters	T1	T2	T3	T4	T5	SEM±
***Eimeria spp* (egg/g/100g)**						
Onset collection	6350	5820	5600	5740	5560	93.69
Final collection	C 149.00	a 5125.00	b 275.00	b 255.00	b 295.00	33.13

[a, b, c,] means along the same row with different superscript are significantly different ($p<0.05$)

Table 5: Shows the growth performance of broiler chicken fed diets with varying level of *C. papaya* leaf meal. Non-significant differences were observed among different treatments on weight gain and feed conversion ratio. The feed intake was similar across treatments except for T2 that differ significantly. However, the feed conversion ratio was not significantly different for all the treatments. The mortality percentage result reveals that T1 had the highest percentage (2.33%) while T4 had the lowest (0.67%) mortality, however T2 and T3 had similar mortality rate (1%).

Table 5: Growth performance characteristics of broiler chicken fed varying level of *C. papaya* leaf meal based diet.

Parameters	T1	T2	T3(200)	T4(400)	T5(600)	SEM±
Initial weight (g)	102.00	102.50	102.40	101.00	102.00	2.88
Final weight (g)	1783.30[ab]	1550.00[c]	1680.00[b]	1800.00[a]	1685.70[b]	46.00
Weight gain (g)	1681.30	1447.50	1577.30	1699.00	1583.70	20.55
Feed intake (g)	4100.00[a]	3500.00[b]	3800.00[a]	3950.00[a]	3850.00[a]	68.00
FCR	2.29	2.25	2.26	2.19	2.28	0.69
Mortality (%)	2.33[a]	1.00[c]	1.00[c]	0.67[d]	1.33[b]	0.05

[a, b, c, d] means along the same row with differences superscripts are significantly different ($p<0.05$). SEM = Standard Error of mean

Tables 6 shows the carcass characteristics of broiler chicken fed diet containing varying levels of *C. papaya* leaf meal. Result shows that there were no significant differences on all the carcass parameters except that of the live weight, which was significantly different among treatments. The lowest live weight were obtained from birds on diet T2 that were neither treated with anticoccidial drug nor *C. papaya* leaf meal, this might be as a result lower feed conversion.

Table 6: Carcass characteristics of broiler chicken fed with *C. papaya* leaf meal (%) based diets

Parameters	T1	T2	T3 (200g)	T4 (400g)	T5 (600g)	SEM
Live weight (g)	1683.33[a]	1450.00[c]	1591.67[b]	1688.33[a]	1591.67[b]	15.60
Plucked %	87.13	88.51	87.95	87.13	87.43	7.50
Eviscerated %	73.76	75.88	72.78	73.76	75.39	5.20
Dressing %	67.27	66.68	67.64	67.85	69.54	2.20
Cut parts (% DW)						
Breast %	19.09	17.69	17.22	19.09	18.03	1.22
Thigh %	20.29	18.12	21.48	20.92	20.50	2.10
Drum stick %	10.23	10.75	10.44	10.23	9.59	1.30
Organ weight (%LW)						
Gizzard %	3.15	3.25	3.30	3.15	3.34	0.10
Liver %	2.52	2.17	2.49	2.53	2.28	0.20
Heart %	0.54	0.69	0.56	0.54	0.53	0.10

[a, b, c,] means along the same row with different superscripts are significantly different ($p<0.05$).

Table 7 shows the hematological parameters of broiler chicken fed diets with varying levels of *C. papaya* leaf meal, significant differences were observed in the packed cell volume, red blood cell, white blood cell count, lymphocytes, heterophils, monocytes and eosinophil levels of the birds, however, the values obtained for hemoglobin, platelets and basophils were not significantly different among treatments.

Table 7: Hematological parameters of broiler fed varying levels of *Carica papaya* leaf meal based diet

Parameter	T1	T2	T3	T4	T5	SEM±	Range
Packed cell volume (%)	ab 35.00	c 25.00	a 37.00	a 38.00	B 33.00	0.36	24.90-45.20
Hemoglobin (g/dl)	11.06	8.04	12.03	12.03	11.00	0.35	7.40-13.10
Red blood cell (10^{12}/L)	ab 3.54	c 2.43	a 3.57	b 3.51	B 3.46	0.04	1.58-4.10
White blood cell (10^{12}/L)	a 13.65	10.00^{c}	b 12.25	b 11.60	b 11.40	0.06	9.20-31.00
Platelets (µL)	20.80	22.00	21.10	29.20	22.00	0.17	15.60-60.40
Lymphocytes (%)	b 62.00	a 78.00	b 60.00	b 68.00	B 64.00	4.90	43.90-67.70
Heterophils (%)	c 21.00	a 24.00	b 23.00	b 23.00	C 21.00	1.45	25.20-35.10
Monocyte (%)	ab 4.00	a 5.00	b 3.00	c 2.00	b 3.00	0.30	0.06-9.10
Eosinophil's (%)	ab 3.00	c 2.00	ab 3.00	a 4.00	C 2.00	0.33	6.25-9.66
Basophils (%)	1.00	1.00	0.00	1.00	0.00	0.28	2.50-5.36

a, b, c, means with different superscripts are significantly different ($p<0.05$)

Discussion

Phyto-chemical constituents of *C. papaya* leaf meal indicated that its leaves contain alkaloid, saponin, tannin, glycosides and flavonoids and this is in agreement with previously reported studies (33, 19). However, the presence of tannin obtained in this result was contrary to the report of (34) who reported the absence of tannins in pawpaw leaves screened and this could be as a result of a variation in age of leaves or topographical location of the pawpaw plant used. The presences of saponin in the leaves supports the facts that pawpaw leaf has cytotoxic effects and can permeate the intestinal wall; they also give the leaves the bitter taste (35). Alkaloids are also moderately present in the leaves of pawpaw. Alkaloids are most efficient therapeutically significant substance used as basic medicinal agents because they possess antiplasmodic, analgesic, and anti-bacterial properties (36). However, the leaves also contain flavonoid, terpene, oxalates and phenols in minute level. Flavonoids improve health status of both plant and animal and could prevent oxidative reactions. All the phytochemical components indicate that *C. papaya* leaves are of health benefit to both animal and human when consumed in diet as food and for therapeutic purpose. They could be of economic importance to the industries, both Agricultural and Pharmaceutical.

Oocyst count of broiler chicken fed diet containing varying levels of *C. papaya* leaf meal indicates the amount of Eimeria Oocyst presence in the fecal samples at the onset and at 10 days post-infection. This reveals that significant differences were observed in the treatments. The birds in T1, T3, T4 and T5 had lower oocyst count when compared with the birds in T2. T1 had the lowest oocyst count due to the coccidiostat (Embazin forte) that was used for the birds while the higher value obtained from T2 was due to the fact that the birds were not medicated with coccidiostat nor treated with *C. papaya* leaf meal. This clearly indicate the effectiveness of the anticoccidial used in T1 and the potency of papaya leaf meal used in T3, T4 and T5 which compared favorably with those of the control. In the infected group, the clinical signs displayed could be due to tissue destruction from the release of merozoites and oocysts from the mucosal surface during the last generations of merogony and throughout gametogony, much of the mucosal epithelium was sloughed off and compromised nutrient absorption.

The performance characteristics indicate significant difference in the body weight, the highest weights were obtained from T4 (1800g) while the lowest weight was from T2 (1550g). The lower weight obtained from birds on T2 could be as a results of reduced nutrient absorption due to the destruction of the epithelia cells of the intestine (37, 20). The weight obtained in this trial was however lower than that obtained by (38) who evaluate the effect of dietary inclusion of pawpaw leaf meal on the performance of finishing broilers; this could be as a result of the inclusion levels of pawpaw. Reduced feed intake observed across the treatments could be as a result of the phytochemicals: such as enzyme (papain), alkaloids and phenolic in the pawpaw leaf which might also reduce the acceptability of the feed (34). However, no significant differences were observed in the feed conversion ratio of birds fed diets containing varying level of *C. papaya* leaf meal, although the values varied numerically within treatments, with birds on T4 having the best FCR. Also, birds on T4 had higher survivability rate, as the percentage mortality was lowest. However, the birds on the control diet T1 had the highest mortality rate which may mean that the immune system of the birds might have been compromised by the drug used for the birds (7). Although, the improved performance observed as level of Papaya leaf meal increases up to 400 g /100kg which later reduces at higher level of inclusion of *C. papaya* leaf meal in the diets is in harmony with earlier opinion that at high levels of leaf meal inclusion, growth is depressed (39).

No significant differences were observed in the carcass characteristics, except that of live weight which was the resultant effects of the feed intake of the birds. The birds on T4 compared favorably with that in T1. The superior values of the dressing percentages of birds on T1 and T4 is an indication that total edible meat from birds on these treatments are higher than the meat yield from other treatments. This is in alliance with the findings of (38). Packed Cell Volume is one factor involved in the transporting of oxygen and absorption of other nutrients. Higher PCV obtained in this result from birds on coccidiostat and papaya leaves indicate a better transportation of oxygen and thus results in an increased polycythemia. However, the values of hemoglobin obtained in this trial were not significantly different among treatments; the physiological function of Hb is to transport oxygen to tissues of the animal for oxidation of ingested food so as to release energy for the other body functions as well as to transport carbon dioxide out of the body of animals (40, 41). From this report, it shows that T1, T3, T4 and T5 had higher RBC values; this stipulate better transport of oxygen to the tissues as well as the level of carbon dioxide returned to the lungs of the birds (41) when compared with the birds on T2. The major roles of the white blood cell and its differentials are to fight infectious contaminations, defend the body by phagocytosis against invasion by foreign organisms and to produce or at least transport and distribute antibodies in immune response. Animals with low white blood cells as experienced in this trial (T2) which also had a higher level of oocyst count are exposed to high risk of disease infection; this could be credit to the fact that they were not medicated with coccidiostat nor papaya leaf meal, while those with high counts are capable of generating antibodies in the process of phagocytosis (41, 42). The platelets values obtained in this trial were not significantly different among treatments and were within normal limit. Blood platelets are the cause of blood clotting, low platelet numbers indicates that the process of clot formation will be prolonged resulting in excessive loss of blood in the case of injury (43). High levels of lymphocytes show that the body is dealing with an infection or other inflammatory conditions as observed in T2 when compared with other treatments. Heterophils are the major phagocytic leukocytes, they have important roles in innate immune system, including mediating the acute inflammatory response, Heterophils exhibit superior ability to monocytes, both to phagocytize and kill bacteria (44).Values obtained for monocytes, eosinophils and basophiles are within the normal range for healthy birds (45, 46). It was reported by (47) that the number of Heterophils in the blood increases rapidly when acute infection is present; hence a blood count showing increase is useful in diagnosis of infections, which is in alliance with the result obtain in this trial. The higher value obtained in T2 is as a result of infection, this is also implies by the higher levels of oocyst count obtained for this treatment. The low values of monocytes and basophils is in league with the statement that basophils and monocytes are normally present in small to moderate number in the blood system (48). For Eosinophil, T4 had the highest value, eosinophil is known to protect animal against infection. This shows birds on this treatment were able to fight against the infection; other treatments were also high but not as high as T4. This result is in consonant with the previous works of (49) that used *Vernonia amygdalina* leaf meal for broiler birds.

Conclusion and Applications

1. Inclusion of *Carica papaya* leaf meal in diet of broilers is safe and has no adverse effect on the growth and carcass characteristics of broiler chickens.
2. It can therefore be recommended that 400g of *Carica papaya* leaf meal can be included in practical broiler diets.

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