Effect of *Carica papaya* Aqueous Leaf Extract on Growth Performance and Blood Characteristics of Weaner Rabbits

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Abstract

In the face of increasing demand for food by man and animals and the cost of conventional feed ingredients it has become overwhelmingly imperative source for alternative feeding sources that have no direct usage to man and can ameliorate the cost of production. On this, a 70-day study was carried out to determine the influence of Carica papaya aqueous leaf extract (CPALE) on the blood characteristics and performance of growing rabbits. The experiment was done in a complete randomized design (CRD) using 24 growing rabbits of New Zealand White breed. Treatment 1 (control) had no CPALE while experimental extracts were administered to treatments 2, 3 and 4 in the following proportions; 0.1, 0.2 and 0.3 (100, 200 and 300mls) respectively per litre of distilled water. Other dietary feed ingredients were supplied on weight equalization basis. Result from haematology revealed that there were significant (P<0.05) differences on the PCV, WBC, MCV and MCHC while Hb, RBC and MCH were not significantly (P>0.05) affected by the dietary treatment. The serological indices assayed were all significantly (P<0.05) affected except creatinine which was not affected by the treatment diet. Similarly, the performance result revealed significant (P<0.05) differences on the average live weight, total weight gain and daily weight gain while other parameters such as total feed consumed, daily feed consumed, feed conversion ratio and protein efficiency ratio were not significantly (P<0.05) influenced by the treatment diets. Conclusively, treatment diets performed better than the control diet and the blood characteristics assayed were within range as there was no indication of diseases traceable to the blood parameters.

Keywords: Rabbit, *carica papaya*, growth, haematology and serum.

Effet de l'Extrait Aqueux de Feuilles de *Carica papaya* sur les Performances de Croissance et les Caractéristiques Sanguines des Lapins Sevrés

Résumé

Face à la demande croissante de nourriture par l'homme et les animaux et au coût des ingrédients alimentaires conventionnels, il est devenu extrêmement impératif de recourir à des sources d'alimentation alternatives qui n'ont pas d'utilité directe pour l'homme et peuvent réduire le coût de production. Sur ce point, une étude de 70 jours a été réalisée pour déterminer l'influence de l'extrait aqueux de feuilles de Carica papaya (EAFCP) sur les caractéristiques sanguines et les performances des lapins en croissance. L'expérience a été réalisée selon un plan randomisé complet (PRC) utilisant 24 lapins en croissance de race blanche de Nouvelle-Zélande. Le traitement 1 (témoin) ne comportait pas de EAFCP alors que des extraits expérimentaux ont été administrés aux traitements 2, 3 et 4 dans les proportions suivantes : 0,1, 0,2 et 0,3 (100, 200 et 300 ml) respectivement par litre d'eau distillée. D'autres ingrédients alimentaires diététiques ont été fournis sur une base d'égalisation du poids. Les résultats de l'hématologie ont révélé qu'il y avait des différences significatives (P < 0,05) sur le PCV, les WBC, le MCV et le MCHC, tandis que l'Hb, le RBC et le MCH n'étaient pas affectés de manière significative (P > 0,05) par le traitement diététique. Les indices sérologiques dosés étaient tous significativement (P<0,05) affectés sauf la créatinine qui n'était pas affectée par le régime alimentaire

de traitement. De même, le résultat de performance a révélé des différences significatives (P <0,05) sur le poids vif moyen, le gain de poids total et le gain de poids quotidien, tandis que d'autres paramètres tels que l'aliment total consommé, l'aliment consommé quotidiennement, le taux de conversion alimentaire et le rapport d'efficacité protéique n'étaient pas significatifs (P < 0,05). P <0,05) influencé par les régimes alimentaires. En conclusion, les régimes de traitement ont donné de meilleurs résultats que le régime témoin et les caractéristiques sanguines analysées étaient dans les limites car il n'y avait aucune indication de maladies imputables aux paramètres sanguins.

Mots-clés : Lapin, carica papaya, croissance, hématologie et sérum.

Introduction

This coprophagic and nocturnal animal is found to be nutritious, low in fat, delicious and provides a suitable alternative to poultry meat (Banerjee, 2011). The need to increase livestock production as a way of alleviating gross shortage of animal protein cannot be overemphasized in the face of mounting population increase, high level of poverty and the devastating flood across the Nigerian coastal regions. Rabbit is well accepted across the ethnic, religious and traditional lines of Nigeria and beyond. The animal utilizes fibre better than other non-ruminant animals owing to its enlarged "caecum" that enhances the unique type of digestion called "coprophagy. The feeding of *Oryctolagus cuniculus* offers no appreciable competition with man for most of the conventional feed ingredients (Etchu *et al*., 2017). They possess certain characteristics which endow them than other animals to subsistence farming system such as short gestation period (30-31), small body size, high fecundity etc. Its start-up production is usually a 'low-cost' hence locally fabricated materials could be assembled to build cages and feeding materials.

The global upsurge in population requires a systematic and aggressive increase in the production and supply of animal protein. Seleiman *et al.* (2020) noted that the predicament of population upsurge will pose a serious threat to food security and acute malnutrition if not frontally tackled. Therefore, to meet with the projected population growth, the livestock farmers and researchers must deviate from the conventional approach to feeding, management and general handling of farm animals. *Carica papaya* is one of the plants that are commonly grown (cultivated) across Africa and other continents of the world. It belongs to the family of *Caricaceae.* The plant is herbaceous and bears fruit that is highly nutritious and delicious and serves as a major source of some digestive enzymes (Jiwuba, 2018). The leaves and its extract are rich in antioxidants, vitamins and minerals and are relatively high in fibre which makes it suitable feedstuff for rabbits. This research therefore is targeted at determining the blood profiles and growth performance of weaner rabbits fed the aqueous extract of *carica papaya* leaf.

Abbreviatios: CPALE = *Carica papaya* aqueous leaf extract

Materials and Methods

Experimental Location: The feeding trial was carried out at the Rabbitry Unit of the Teaching and Research Farm of Dennis Osadebay University, Asaba, Delta State, Nigeria for a period of seventy days. The farm is located on longitude 60º 45ºE and latitude 60º 12º N in the derived Savanna Vegetation zone. It is situated about four kilometers from the River Niger with a maximum ambient day temperatures range of 27.50^{oC} to30.90^{oC} (Federal Ministry of Aviation; Department of Metrological Services, Asaba, 2014). The annual rainfall ranges from 1800mm-3000mm which alternates with dry season.

Sources of Ingredient and Sample Preparation:

Carica papaya leaves were sourced from the local environment of the university in Asaba while other ingredients such as maize, wheat offal, palm kernel meal, palm oil, soybean meal, fish meal, bone meal, premix, salt, oyster shell, methionine were sourced from Animal Feedstore also in Asaba. The matured *Carica papaya* leaves were properly rinsed to remove dirt and possibly washed off pathogenic organisms. Thereafter, the experimental ingredient was air-dried at room temperature (20-25^{o}C) until the leaves became gritty and ready for milling. They were milled in a mechanical blender to pass through 0.5mm sieve. Four kilogramme (Kg) of the milled leaf was soaked in twenty (20) litres of distilled water and allowed to stay for six hours before the extract was filtered in accordance with Mrinal and Bhushan (2017). After decanting the supernatants the extract was preserved in the refrigerator at 5^{o}C until usage.

Chemical Analysis of Experimental Ingredients

The experimental aqueous extract of *Carica papaya* was analyzed for its moisture content, ash, crude protein, crude fibre, crude fat and nitrogen free extract using the methods of AOAC (2000).

Table 1: Proximate Composition of *Carica papaya* aqueous leaf extracts

Nutrient	%
Ash	7.21
Crude Protein	15.89
Moisture	8.93
Crude fibre	20.48
Crude fat	3.03
NFE	47.68

Experimental Design and Weaner Rabbit Management

The experiment was carried out in a complete randomized design (CRD) using four (4) dietary treatments. Treatment 1 which served as the control had no supplement of *Carica papaya* aqueous leaf extract (CPALE) while treatments 2, 3 and 4 had 0.1, 0.2 and 0.3 litres (100, 200 and 300ml) of *carica papaya* aqueous leaf extract added to 1 litre of distilled water. Twenty four (24) weaner rabbits of New Zealand White Breed with the initial mean weight range of 634.14 to 684.74g purchased from a reputable farm at Ibadan were used. They were assigned into their dietary treatments (1,2,3 and 4) on the basis of weight equalization. The experimental animals were divided into three (3) replicates of two (2) rabbits in each treatment making a total of twenty four (24) rabbits in the four treatments. On arrival, they were administered vitalyte extra to energize them and reduce the effect of stress arising from the long distance journey. The animals were allowed unrestricted access (*ad libitum*) to experimental aqueous extract, clean water and feed throughout the duration of the experiment. The rabbits were allowed a four-day acclimatization period and were properly dewormed in readiness for the feeding trial. The hutches were properly netted and alluminium feeders and waterers were strategically placed and pinned to the cage. The feeders and waterers were washed and disinfected before stocking. The experimental site was cleared to ward off rodents and poisonous snakes.

Table 2: Experimental Feed and Ingreient

Ingredients	T1 Water	T2 0.1 litre (CPALE)	T3 0.2 litre (CPALE)	T4 0.3 litre (CPALE)
Maize	45.00	45.00	45.00	45.00
Palm kernel meal	15.00	15.00	15.00	15.00
Wheat offal	15.00	15.00	5.00	15.00
Fish meal	5.00	5.00	5.00	5.00
Soybean meal	15.00	15.00	15.00	15.00
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00
Palm oil	0.50	0.50	0.50	0.50
Vit. & Min. Premix	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Analyzed:				
ME (Kcal/g)	**2.56**	**2.59**	**2.73**	**2.65**
Crude Protein	**17.86**	**17.93**	**17.82**	**17.94**

Performance Study

In the course of the feeding trials, daily feed intake was taken. The weight gain was recorded weekly while feed conversion and protein efficiency ratios were estimated. The daily feed consumption was determined by taking the weight of the feed given daily and subtracting it from the remnant at the end of the day. The weekly weight gain was determined by estimating the difference between the weight at the beginning of the week and the weight at the end of the week. Feed conversion ratio was determined by dividing the total feed intake by the total weight gain while the protein efficiency ratio was calculated as a ratio of weekly weight to that of weekly protein intake as shown below:

$$\text{Protein efficiency ratio} = \frac{\text{weight gained/week (kg)}}{\text{Protein intake/week (kg)}}$$

On 70th day of the experiment, three rabbits were randomly selected from each treatment with one rabbit taken from each replicate. The blood sample (6ml) was withdrawn from each animal through the conspicuous large ear vein. They were parted into two (2) samples to be used for haematological and serum biochemical analysis. The sample for haematological studies (3ml) was put into a labeled ethylene diamine tetra acetic dipotassium salt (EDTA) bottles while the other sample (3ml) for serum analysis was put into heparinized bottles. The red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV), haemoglobin (H), total protein, albumin, globulin, creatinine, urea and cholesterol were determined using Decie and Lewis (1991) while the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated (Jain, 1986).

Statistical Analysis

The data were subjected to a one-way analysis of variance (ANOVA) and the significant treatment means were compared using the Duncan multiple range test as outlined by Steel and Torrie (1990) with the aid of SAS (1999).

Results and Discussion

Table 3: Haematological Parameters of Weaner Rabbits as Affected by the *Carica papaya* Aquoes Leaf Extract.

Parameters	T1 Water	T2 0.1 litre (CPALE)	T3 0.2 litre (CPALE)	T4 0.3 litre (CPALE)
PCV (%)	42.00[b]	42.41[b]	42.58[b]	43.53[a]
Haemoglobin (g/dL)	14.07	14.36	14.59	14.50
RBC ($X10^6$/mL)	7.31	7.33	7.38	7.64
WBC ($X10^6$/mL)	6.59[a]	5.69[b]	5.78[b]	4.99[b]
MCV (*fl*)	59.94[c]	60.23[c]	61.25[b]	63.14[a]
MCH (*pg*)	20.00	19.94	20.21	20.10
MCHC (%)	6.53[a]	5.69[b]	5.78[b]	4.99[b]

abc: means in the same row with different superscripts are significantly (P<0.05) different.

The result from the above Table shows the haematological implication of the administration of the *Carica papaya* aqueous leaf extract on the weaner rabbit. It significantly (P<0.05) affected the packed cell volume (PCV), mean corpuscular volume (MCV) and white blood cell (WBC) of the experimental animals. The highest (0.3 litres or 300ml) of the extract supplied in treatment four (4) exerted significant (P<0.05) influence on the animals in that dietary treatment. While other experimental treatments (2 and 3) were not significantly (P>0.05) different from the control diet on the packed cell volume. This result is closely related to findings of Jiwuba and Kadurumba (2019) who reported a PCV ranged of 38.61-44.83% on the supply of pawpaw leaf meal to growing rabbits. Again, the mean corpuscular volume (MCV) was superior in diet four followed by diet 3 while diets 2 and 1 were significantly not (P>0.05) different as seen in the following order: 63.14, 61.25, 60.23 and 59.94*fl*. On the contrary, the white blood cell (WBC) was significantly (P<0.05) better in the control diet (1) while the experimental diets were all not significantly (P>0.05) different.

Table 4: Serological Indices of Weaner Rabbits as Affected by the *Carica papaya* Aqueous Leaf Extract.

Parameters		T1 Water	T2 0.1 litre (CPALE)	T3 0.2 litre (CPALE)	T4 0.3 litre (CPALE)
Total protein	(g/dL)	5.31[c]	6.41[b]	6.44[b]	6.85[a]
Globulin	(g/dL)	2.04[c]	2.22[b]	3.03[a]	2.94[a]
Albumin	(g/dL)	1.97[d]	2.51[c]	2.91[b]	3.20[a]
Cholesterol	(mmol/L)	2.56[a]	1.68[b]	1.55[b]	1.03[c]
AST	(u/L)	34.94[b]	35.91[a]	33.88[c]	33.95[c]
ALT	(u/L)	29.04[a]	25.45[b]	25.61[b]	25.34[b]
Creatinine	(mg/L)	1.23	0.89	0.98	1.00

abc: means in the same row with different superscripts are significantly (P<0.05) different.

The Table above revealed that total protein, globulin and albumin were significantly (P<0.05) influenced by the administration of *Carica papaya* aqueous leaf extract. The experimental treatments proved to be better than the control diets suggesting that it must

have exerted influence on the serum biochemical of the animals. This result is in partial agreement with the findings of Lien and Wu (2012) who revealed an increment in the total protein and globulin levels as a result of papain supplementation in laying hens. There was also significant (P<0.05) differences on the levels of cholesterol as indicated in the Table (4). The control diet had higher values of cholesterol compared to the other dietary treatments. This may be interpreted to mean that the experimental extract is hypolipidemic. Phytogenic bioactive compounds of *carica papaya* such as chitinase, papain, lycopene, pectin, alkaloids, glycocides, flavonoids etc may be implicated for its ability to synthesis cholesterol (Bushra and Tajul, 2013). Though the AST and ALT were significantly (P<0.05) affected by the dietary treatments, their values were within normal range for weaner rabbits as reported by Putwain (2008). Also the low levels of creatinine across the treatments add credence to the *Carica papaya* aqueous leaf extract's ability to maintain normal physiological functions of the weaner rabbits.

Table 5: Performance of Weaner Rabbits as Affected by the Treatment Diets.

Parameters	**T1** Water	**T2** 0.1 litre (CPALE)	**T3** 0.2 litre (CPALE)	**T4** 0.3 litre (CPALE)	SEM
Ave. initial weight (g)	786	789	785	790	0.02
Ave. live weight (g)	1643[b]	1730[a]	1764[a]	1781[a]	0.03
Total weight gain (g)	857[b]	941[a]	979[a]	991[a]	0.32
Daily weight gain (g)	12[c]	13[b]	14[a]	14[a]	0.04
Total feed consumed (g)	1635	1634	1616	1624	0.02
Daily feed consumed (g)	23	23	23	23	0.00
Feed conversion ratio	1.91	1.73	1.65	1.64	0.46
Protein efficiency ratio (%)	1.50	1.52	1.56	1.56	0.24

abc: means in the same row with different superscripts are significantly (P<0.05) different.

The result in Table 5 showed that average weight gain, total weight gain and daily weight gain of the weaner rabbits in diets 2, 3 and 4 were significantly (P<0.05) influenced. This may be a testimony on the effect of the active experimental ingredients (CPALE). Values on the parameters above were within range as the rabbits were all physiologically normal. The total live weight of the rabbits on the experimental ingredients ranged from 1730 to 1781g as against 1643g recorded for control diet. This result corroborates with the findings of Jiwuba and Kadunrumba (2019). The increase in the numerical values (1730, 1764 and 1781g) recorded for live weight may suggest a dose related effect and may be attributed to bioactive compounds in the extract. The total and daily weight gain also followed the same trend. Weaner rabbits placed on diets 3 and 4 performed better than those on the control diet. This result is in tandem with the findings of Iwegbu and Igene (2022) who reported an increase in body weight on the administration of *gongronema latifolia* leaf extract. It can be deduced from this research that papaya leaf extract (PLE) have active compound that can stimulate nutrient utilization in growing rabbits. There were no significant (P>0.05) differences on the total feed consumed, daily feed consumed, feed conversion ratio and protein efficiency ratio of the experimental animals. In conclusion, the weaner rabbits placed on test diets (2, 3 and 4) performed better than the control diet. The blood characteristics tested were normal and there was determined diseased arising from the test ingredient.

Conclusion and Recommendation

The experiment revealed that the test ingredient may contain viable bioactive compounds which triggered adequate nutrient utilization in the feed and enhanced performance of the animals. The haematological and serum analysis did not show any abnormality hence there was no determined disease arising from the administration of the extract.

It is hereby recommended as follows:

- that this kind of research be carried with broilers to determine its effect on growth and digestibility,
- that the extract be to test in broilers to ascertain the pharmacological effect in managing coccidiosis.

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