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Evaluation of Growth Performance and Haematology of Weaner Rabbits Fed Varied Levels of Pawpaw (*Carica papaya*) Leaf Meal

[1]Timothy T Kuka, [2]Jerome Unukevwere, [3]Jamiu I Zubair, [4]Joshua T Agedeson
[1, 3] Department of Animal Nutrition, Joseph Sarwuan Tarka University, Makurdi, Nigeria
[2] Department of Animal Production, Delta State University, Abraka, Nigeria
[4] Department of Animal Science, University of Ibadan, Nigeria

Corresponding Author: **Timothy Kuka**, kuka.timothy@uam.edu.ng

Abstract
Utilization of forages and leaf meals in livestock feeding is a strategy to reduce cost of production and provide affordable animal protein for the fast-growing human population. This experiment was conducted to evaluate the effect of feeding pawpaw leaf meal on growth performance and haematology of weaner rabbits. A total of 24 mongrel weaner rabbits of 0.55±0.28 kg in weight were randomly assigned to four treatment groups of six rabbits in a completely randomised design. Treatment one served as control diet with 0% pawpaw leaf meal while treatments two, three and four contained 5 %, 10 % and 15 % pawpaw leaf meal respectively. The study lasted for 56 days with *ad libitum* feeding. The animals were initially weighed, housed per replicates in pen units and weighed weekly thereafter. Feed intake, weight gain and feed conversion ratio were calculated and at the end of the experiment, blood was collected into sterile bottles containing ethylenediaminetetraacetic acid (EDTA) as anticoagulant. The blood samples were analysed for packed cell volume (PCV), Red blood cell (RBC), Haemoglobin (Hb), White blood cell (WBC) and Mean Corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Volume (MCV) were calculated. Growth performance result revealed that feed intake decreased ($P<0.05$) with the inclusion of pawpaw leaf meal but did not affect weight gain and feed conversion ratio. Pawpaw leaf meal improved haematological parameters ($P<0.05$) with best results from the group fed 5%. It can be concluded that moderate inclusion of pawpaw leaf meal in rabbit diets did not affect growth performance and haematology of weaner rabbits.

Keywords: Growth Performance, Haematology, Leaf Meal, Pawpaw, Rabbit

1. Introduction
Rabbit production has potentials to meet the nutritional and employment demands of the society as it is less labourious and less expensive thereby making allowance for even the disabled persons to participate. Owen and Amakiri, (2010) [10], noted the potentials of rabbit production to be high nutritional value of the meat which is high in protein, essential vitamins and minerals with less fats, which makes it ideal for the aged. Rabbits production also require low capital for setup, little space and are well adapted to domestic rearing. In our society of deficient animal protein consumption, rabbits are a viable option to improving protein consumption because of their short gestation period and generation interval, high litter size per year and ability to efficiently convert forages and food wastes to meat. Despite these potentials, rabbit production is however constrained by ignorance about the genetics, management and nutrition of the rabbit as well as the high cost of conventional feed ingredients. With the high cost of conventional concentrate feeds, it becomes imperative to increase the range of forages utilized in rabbit feeding since they can utilize up to 30% crude fibre (Makinde *et al*., 2014) [5].
Some plant leaves such as Mulbery, poplar, leucaena, *moringa oleifera*, *Glircidia sepium* etc have been used either as partial or complete substitute for conventional grains in rabbit diets. Inclusion of leaf meals in rabbit diets is proven to be beneficial as leaves do not only offer nutritional benefits but contain biochemical components that aid digestion and improve intestinal health of animals. Toxicity and adverse effect may be noticed with the use of these resources but that depend on the level of usage and with species (Safwat *et al*., 2014) [11]
Pawpaw (*Carica papaya* L.) belongs to the fruits and vegetable class, it is an invaluable plant that is prevalent throughout tropical Africa (Nwofia *et al*., 2012) [7]. Pawpaw leaves are reported to contain 32.4% crude protein, 6.72 % moisture, 12.63 %

ether extract, 4.2 % crude fiber, 5.30 % Ash and 38.46 % Nitrogen free extract (Olaniyi and Salau 2013) [8]. The leaves are high in carotenoids, vitamins (B_1, B_2, C, E), minerals (Ca, K, P, Fe), low in sodium, fat and calories (Yadava *et al*., 1999). Apart from nutritional content, Pawpaw leaves contain active components that can increase the total antioxidant power in blood and reduce lipid peroxidation, they include papain, chymopapain, cystatin, tocopherol, ascorbic acid, flavonoids, cyanogenic glycosides and glucosinolates (Noriko Otsuki *et al.*, 2010). The proteolytic enzymes papain and chymopapain, have protein digesting properties and are useful in controlling digestive problems and intestinal worms as well as cleansing the digestive tract (Abd-ELGhany *et al*., 2021) [4].

However, reports of rabbit performance on pawpaw leaf meal are scarce, hence, the need to evaluate the effect of pawpaw leaf meal as a feed resource for rabbits.

2. Materials and Methods

The experiment was conducted at the rabbitry unit, Federal College of Agriculture, Ishiagu Ebonyi State.

2.1 Experimental material and diets

Fresh leaves of pawpaw (*Carica papaya*) were harvested within Ishiagu. The leaves were chopped into smaller bits, air-dried and milled with a grinding machine to produce pawpaw leaf meal. Four experimental diets were formulated to meet the nutrient requirements of weaner rabbits. The leaf meal was incorporated into the diets at 0 %, 5 %, 10 % and 15 % to form the experimental treatments. The rabbits were also provided with fresh tridax daily after supplying the concentrate feed.

Table 1: Percentage composition of weaner Rabbit diet (g/100g)

Ingredients	0 % PLM	5 % PLM	10 % PLM	15 % PLM
Maize	43	43	43	43
Wheat offal	13	11	11	10
Palm cannel cake	21	21	21	18
Fish meal	1	1	1	1
Soybean meal	18	15	10	9
Pawpaw leaf meal	0	5	10	15
Bone meal	2	2	2	2
Lime stone	1	1	1	1
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Calculated nutrients				
Crude Protein	18.5	18.0	17.1	17.2
ME (Kcal/Kg)	2639.8	2629.8	2608.8	2600.0

PLM = pawpaw leaf meal
ME= Metabolizable energy

2.2 Experimental Animals and management

Twenty-four (24) unsexed mongrel weaner rabbits of six weeks average were used for the experiment. They were randomly divided into four (4) experimental groups of six animals per treatment with two replicate per treatment and three animals per replicate. Animals were housed in pen units and provided with feed and water *ad libitum*. The animals were dewormed with ivermectin prior to the commencement of the study.

2.3 Sample/Data collection and analysis

Initial weight of the rabbits were taken at the onset, thereafter the rabbits were weighed weekly to obtain weight gain. Weighed amounts of feed were offered and left over were weighed to determine feed intake, feed conversion ratio were calculated from the record of feed intake and weight gain. At the end of the feeding trial, blood samples were randomly collected from two animals per treatment using sterile needles and syringes. One (1) ml of blood was collected into properly labeled sterile bottles containing Ethylenediaminetetraacetic acid (EDTA) as anti-coagulant for haematological analysis. Parameters considered were: Packed Cell Volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), Haemoglobin concentration (Hb), Mean Corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Volume (MCV). Data collected were subjected to one way analysis of variance (ANOVA) and means were separated using Duncan's Multiple Range Test in SAS, (2009). Values were considered to be significant at $p<0.05$.

3. Results and Discussion

3.1 Growth performance

Result of growth performance of weaner rabbits fed pawpaw leaf meal is shown in table 2 below. Feed intake differed significantly ($P<0.05$) among the groups ranging from control with the highest value and 15 % leaf meal with the lowest values. This decline may be due to palatability issues. However, weight gain and feed conversion ratio were observed to be similar ($P>0.05$). It is important to note that if animals eat less yet are able to efficiently covert the feed to meat by gaining similar weight with those that ate much, then it is an advantage to the farmers since his resources are conserved.

This result contrasts the report of Salau *et al*, (2015) who fed similar and higher levels of pawpaw leaf meal and reported weight gain to significantly reduce with increased pawpaw leaf meal without affecting feed intake. It appears the level of inclusion of pawpaw leaf is a factor of concern in respect to their performance, hence inclusion should be limited to lower amounts.

Table 2: Growth performance of weaner Rabbit fed diets containing Pawpaw leaf meal

Parameters	0%	5%	10%	15%	SEM
Av. Initial body weight (kg)	0.53	0.47	0.48	0.49	0.02
Av. Final body weight (kg)	1.54	1.85	1.55	1.64	94.09
Total feed intake (Kg)	11.34^{a}	11.19^{ab}	11.29^{ab}	11.13^{b}	34.55
Av. daily feed intake (Kg/d)	0.20^{a}	0.19^{ab}	0.20^{ab}	0.20^{b}	0.62
Total weight gain (Kg)	1.01	1.38	1.07	1.15	102.35
Av. daily weight gain (Kg/d)	0.02	0.02	0.02	0.020	1.73
Feed conversion ratio	10.00	8.39	10.56	9.68	0.75

[a, b,] means within a row with different superscripts are significantly ($P<0.05$) different
Av.: average, SEM: standard error of mean

3.2 Hematology

Blood is an important index of physiological, pathological and nutritional status of an organism (Olorode *et al.*, 2007) [9]. Haematological indices are used to monitor the effect of feed or environment on the health of animals. The result of haematological indices of weaner rabbits fed pawpaw leaf meal diets is shown in table 3. The haematological components analysed were PCV, Haemoglobin, RBC, WBC, MCV, MCH and MCHC. Significant differences were observed across the treatments in all the parameters with the control having least values. This could be attributed to vitamins and mineral composition of pawpaw leaf which includes the B vitamins and iron responsible for blood formation. Sodium also helps in alkalizing the blood (Atta, 1999) [3]. It is clear that pawpaw leaf meal promoted haematopoesis leading to improved haematological parameters. Nodu *et al*, (2014) [6], also reported improvement in haematological values of rabbits fed pawpaw leaf meal pointing to similar attributes. In this study, the haematological improvement was observed to be best in 5% leaf meal group. This also points to the fact that inclusion of pawpaw leaf meal in diets of rabbits should be limited to lower amounts.

Table 3: Haematology of weaner rabbits fed diet containing pawpaw leaf meal

Parameters	0 %	5 %	10 %	15 %	SEM
PCV (%)	38.60^{d}	44.80^{a}	40.40^{c}	41.50^{b}	0.85
Hb (g/dL)	10.6^{d}	14.2^{a}	11.6^{b}	11.50^{c}	0.51
RBC ($X10^{12/L}$)	5.34^{d}	6.71^{a}	5.42^{c}	5.49^{b}	0.21
MCH (%)	19.80^{d}	21.16^{b}	21.40^{a}	20.95^{c}	0.23
MCV (pg)	72.3^{c}	66.77^{d}	74.60^{b}	75.59^{a}	3.65
MCHC (%)	274.0^{d}	317.0^{a}	287.0^{b}	277.0^{c}	18.18
WBC ($X10^{12/L}$)	4.5^{d}	8.3^{c}	9.50^{a}	8.70^{b}	0.73

^{abc} means within a row with different superscripts are significantly different (P<0.05). PCV: Packed Cell Volume, RBC: Red Blood Cell, WBC: White Blood Cell, Hb: Haemoglobin, MCHC: Mean Corpuscular Haemoglobin Concentration, MCH: Mean Corpuscular Haemoglobin, MCV: Mean Corpuscular Volume, SEM: standard error of means

4. Conclusion

Evaluation of growth performance and haematology of weaner rabbits fed pawpaw leaf meal proved the potential of pawpaw leaf meal as a feed resource for rabbits nutrition. The inclusion reduced feed intake without adverse effect on weight gain and feed conversion ratio as well as improved haematological values of the animal. In conclusion, pawpaw leaf meal can be used in rabbit nutrition for efficient production but the level of inclusion should be kept low. We recommend 5% inclusion of pawpaw leaf meal in rabbit feeds

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