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Full Length Research

Post – weaning performance of F_1 progeny of rabbits fed pawpaw (*Carica papaya*) leaves as feed supplement

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ABSTRACT: The study was conducted to examine the post – weaning performance of F_1 progeny of rabbits fed pawpaw (*Carica papaya*) leaves as feed supplement. Twenty-four (24) cross bred (New Zealand White X Chinchila) weaned rabbits of four (4) weeks of age (average weight of 208.41 g) of mixed sex were used. The rabbits were divided into two dietary treatment groups comprising of twelve rabbits each. Treatment groups were designated as T_1 and T_2 for rabbits fed fresh pawpaw leaves and wilted pawpaw leaves respectively. In addition to pawpaw leaves formulated concentrate containing crude protein level of 14.75% and energy level of 2488.68 KCal/kgME was used. The feeding trial lasted 6 weeks. Feed and water were provided *ad libitum*. T-test was used to compare the means of both treatments. Results obtained revealed an average final body weight of 1483.73 g (T_1) and 1000.28 g (T_2) at the end of 6 weeks. Average total feed intake values were 189.34g (T_1) and 189.06g (T_2), average pawpaw leaves intake for T_1 was 94.24 g and T_2 94.20 g with feed conversion ratio of 0.94 and 0.84 for T_1 and T_2, respectively. These parameters were not significantly ($P > 0.05$) affected by dietary treatments, except for final body weight, average weekly and daily weight gains. Final body weight, average weekly and daily weight gains were significantly higher ($P < 0.05$) for rabbits served fresh pawpaw leaves. Results obtained from this study have shown that fresh pawpaw leaves can be utilized by weaner rabbits as feed supplement with concentrates compared with wilted pawpaw leaves.

Keywords: Chinchila, growth performance, mix-sexed, New Zealand White, phenotypic correlation, rabbits.

INTRODUCTION

The limitation in the production of livestock products to meet human and industrial needs is scarcity of feed resources (Agbede and Aletor, 2003) especially protein sources which have resulted in declining productivity in animal production in most areas of the world, especially in developing nations (Nodu et al., 2014). Fetuga (1997) reported on the disappointing rate and level of performance in the livestock industry in Nigeria. This he attributed, among other factors, to high cost of feeds arising largely from fluctuations in feed supplies, rising prices of ingredients, poor quality feeds, inefficiency in production and distribution in the feed industry. Rabbit production can increase the low animal protein intake of Nigerians at lower cost.

Rabbits are herbivores with post – gastric digestion and can effectively utilize fodders and serve as alternative sources of meat for poor city dwellers (Alikwe et al., 2014). As monogastrics, they possess a digestive system that can cope with fibrous plant materials, such as grasses, legumes or their hays, and also thrive on forage diets (Adegbola et al., 1985). Rabbits have the ability to convert feedstuff such as forages, most agricultural by – products, kitchen waste and others that humans cannot consume directly into highly nutritious meat. Rabbits are highly prolific, cheap to maintain because they can utilize roughages, have rapid growth rate, high dressing percentage and short gestation period. However, efficient rabbit production is largely dependent on adequate and balanced nutrition (Stanford, 1979).

Aduku and Olukosi (1990) reported a range of 2390 to 2500 kcal/kg of energy and crude protein level of 12 to 17% for optimum performance of rabbits in the tropics. In

recent years, there have been renewed interests in the use of non – conventional ingredients in feed formulation for livestock. To make rabbit rearing more viable as a small scale business, Makinde et al. (2014) advocated the development of alternative feeding materials that will be relatively cheap when compared to commercial feed or conventional feedstuff. Alternative feed sources such as pawpaw (*Carica papaya*) leaves need to be investigated.

Pawpaw is a plant native to tropical America, but it is popular in the tropics and subtropics because of its easy cultivation, rapid growth rate, quick economic returns and adaptation to diverse soils and climate (Campbell, 1984). The leaves are rich sources of proteolytic enzymes papain and chymopapain (Poulter and Caygil, 1985). These enzymes have protein digesting properties and are useful in controlling digestive problems and intestinal worms as well as cleansing the digestive tract (Poulter and Caygil, 1985; Burkhill, 1985). Fresh green pawpaw leaf is an antiseptic, whilst brown dried pawpaw leaf is the best as a tonic and blood purifier (Atta, 1999). This research therefore is aimed at investigating the post – weaning performance of F_1 progeny of rabbits fed pawpaw leaves as feed supplement.

MATERIALS AND METHODS

Location and duration of study

The study was conducted at the Rabbitary Unit of the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Forestry and Wildlife Resources Management, University of Calabar, Calabar, Cross River State. Calabar have a longitude of $8^0 17^I$ and $10^0 43^I$E and latitude of $4^0 58^I$ and $15^0 39^I$N of the equator. Annual rainfall and temperature ranges from 1260 to 1280 mm and 25 to 30^0C respectively. The relative humidity is 51 to 98% (NMA, 2017). The study lasted for six weeks.

Experimental animals and diet

A total of twenty-four (24) crossbred New Zealand White (NZW) X Chinchila (CH) mixed sex weaner rabbits of four weeks of age with known weight ranging between 566.76 and 716.83 g were used in this study. These rabbits were randomly divided into two treatment groups with each replicated three times in a Completely Randomized Design (CRD).

Experimental diets for rabbits comprised formulated ration + fresh pawpaw leaves (T_1) and formulated ration + wilted pawpaw leaves (T_2). The gross composition of the formulated ration is shown in Table 1.

Sources of test ingredient

Pawpaw leaves were collected from within and outside the farm but within the University environment. The rabbits were served 100 g of pawpaw leaves daily. T_1 pawpaw leaves were harvested at 7:00 am daily and kept under the shade for about an hour to allow for moisture to dry off the leaves before being served to the rabbits, whereas for T_2 the leaves were harvested between 3:00 to 4:00 pm prior to the day they were served, stored under room temperature and served the following morning to rabbits at 7:30 am.

Table 1. Gross composition of experimental ration.

Ingredients	Percentage
Yellow maize	38.00
Soybean meal	26.00
Rice husk	25.00
Wheat offal	6.00
Palm oil	1.00
Bone meal	3.00
Mineral/Vitamin Premix	0.25
Salt	0.30
Total	100.00

Data collection

Data on body weight gain and linear measurements were collected weekly while feed intakes were measured daily. Body weights of rabbits were individually weighed weekly in each replicate. The quantity of feed fed to the rabbits was measured and recorded on daily basis and the left over subtracted from the quantity fed the previous day to determine the quantity consumed by each replicate, then average feed consumed by each rabbit was deduced. The parameter used to assess feed conversion ratio (FCR) was the feed/gain ratio, calculated as the ratio of average weekly feed intake (g) to average weekly live weight gain (g).

Data analysis

Data collected were subjected to descriptive statistics. The mean between the groups was separated using T-test in a Completely Randomized Design Using GenStat (2011).

RESULTS

Growth performances of weaned rabbits are presented in Table 2. Results obtained showed that average total feed intake, average pawpaw leaves intake and feed conversion ratio were not significantly ($P > 0.05$) affected by pawpaw leaves between the dietary treatment groups

Table 2. Growth performance of weaned rabbits fed pawpaw leaves.

Parameters	Treatments		± SEM	LOS
	T_1	T_2		
Average initial body weight (g)	716.83	566.76	6.13	-
Average final body weight (g)	1483.73[a]	1000.28[b]	10.99	**
Average weekly weight gains (g)	127.82[a]	72.25[b]	4.14	**
Average daily weight gains (g)	18.26[a]	8.93[b]	2.17	**
Average weekly feed intake (concentrate) (g)	189.34	189.06	0.26	NS
Average pawpaw leaves intake (g)	94.04	94.20	0.20	NS
Feed conversion ratio	1.48	2.62	0.18	NS
Mortality (No.)	0.00	5.00	-	-

T_1 = fresh pawpaw leaves, T_2 = Wilted pawpaw leaves, LOS = level of significance, NS = Non significant (P > 0.01), ** = significant (P < 0.01).

Table 3. Linear body measurements of weaned rabbits.

Parameters (cm)	Treatments		± SEM	LOS
	T_1	T_2		
Body length	19.63	19.47	0.20	NS
Heart girth	12.99	13.18	0.22	NS
Height	11.08	11.80	0.42	NS

SEM = standard error of mean; LOS = level of significant.

Table 4. Phenotypic correlation of weaned rabbits at 5 weeks fed fresh pawpaw leaves.

Parameters	BW	HG	HT	BL
BW	1.00			
HG	-0.19	1.00		
HT	-0.33	0.99	1.00	
BL	0.85	.035	0.21	1.00

BW = body weight, HG = heart girth, HT = Height, BL = Body length.

while average final body weight, average weekly and daily weight gains were significantly (P < 0.05) affected by the treatments.

Linear body measurements of weaned rabbits are presented in Table 3. There was no significant (P>0.05) treatment effect on body parameters. Body parameters (body length, heart girth and height) of rabbits were similar within the treatment groups.

Correlation analysis at 5 and 8 weeks of age for weaned rabbits are presented in Table 4, 5, 6 and 7, respectively. Correlation coefficients varied between the different linear body measurements and body weight. Correlation coefficients for T_1 at 5 weeks (Table 4) and 8 weeks (Table 5) for almost all parameters were negative. Correlation coefficients for T_2 at 5 weeks (Table 6) for almost all parameters were negative although highly (P<0.01) significant. At 8 weeks (Table 7) correlation coefficients were positively (P<0.05) correlated for all parameters evaluated.

DISCUSSION

Final body weights were 1483.73 g and 1000.28 g for T_1 and T_2 respectively. The value for T_2 falls within the range of 1005.00 to 1141.30 g reported by Adeyina et al. (2010) who used hot water treated cocoa bean shell meal, but value obtained for T_1 rabbits was higher. The observed differences may be due to the test ingredients used in feeding the rabbits. Average weekly and daily weight gains were significantly (P < 0.01) affected by the dietary treatments. T_1 had the highest value of 127.82 g while T_2

Table 5. Phenotypic correlation of weaned rabbits at 8 weeks fed fresh pawpaw leaves.

Parameters	BW	HG	HT	BL
BW	1.00			
HG	-0.97	1.00		
HT	0.96	-0.84	1.00	
BL	0.77	-0.91	0.55	1.00

BW = body weight, HG = heart girth, HT = Height, BL = Body length.

Table 6. Phenotypic correlation of weaned rabbits at 5 weeks fed wilted pawpaw leaves.

Parameters	BW	HG	HT	BL
BW	1.00			
HG	-1.00**	1.00		
HT	1.00**	-1.00**	1.00	
BL	-1.00*	1.00**	-1.00**	1.00

BW = body weight, HG = heart girth, HT = Height, BL = Body length, ** = significant at P<0.01, * = significant at P<0.05.

Table 7. Phenotypic correlation of weaned rabbits at 8 weeks fed wilted pawpaw leaves.

Parameters	BW	HG	HT	BL
BW	1.00			
HG	0.93	1.00		
HT	0.84	0.59	1.00	
BL	0.87	0.62	1.00*	1.00

BW = body weight, HG = heart girth, HT = Height, BL = Body length, * = significant at P<0.05.

was 62.54 g for weekly gain. Average daily weight gains followed the same trend with the highest recorded for T_1 (27.76 g) while T_2 had the least (8.93 g).

Average weekly feed intake between the treatments groups were similar suggesting that rabbits fed fresh pawpaw leaves and those fed wilted pawpaw leaves consumed about the same quantity of feed. Rabbits in T_1 consumed 189.34 g while T_2 had 189.06 g. These values were higher than the values of 48.72 to 55.36 g reported by Orunmuyi et al. (2006) who fed graded levels of palm kernel cake to determine the growth performance of growing rabbits. The results for average pawpaw leaves intake was not significantly ($P > 0.05$) affected.

Feed conversion ratio obtained in this study were 1.48 (T_1) and 2.62 (T_2). These values were far better than the 7.75 and 8.33 reported by Saulawa et al. (2015) who fed weaner rabbits diets supplemented with pawpaw leaf meal. T_1 recorded no mortality while T_2 recorded 5% mortality.

The value of 19.63 cm (T1) and 19.47 cm (T2) obtained for body length were lower than the values of 25.46 and 28.92 cm reported by Henry et al. (2013) who used Citrus sinensis pilp as test ingredient in rabbit diet. The variation may be due to the difference in feeding materials used, strains of rabbits as well as age differences of experimental animals. The range of 12.99 to 13.18 cm obtained in this study for heart girth is lower than the value of 19.21 and 22.66 cm reported by Henry et al. (2013).

At five weeks of age, correlation coefficients for linear body measurements to body weight and other measurements were mostly positive except for heart girth versus body weight (-0.19) and height versus body weight (-0.33) for rabbits fed fresh pawpaw leaves. Wilted pawpaw leaves showed positive correlation except hearth girth and body weight (-1.00), body length and body weight (-1.00), height and heart girth (-1.00) and body length versus height (-1.00). The negative correlation observed at 5 weeks of age could be attributed to post – weaning stress

on rabbits in adjusting to separation from their mothers. At 8 weeks, negative correlation values were obtained between heart girth and body weight (-0.97), height and heart girth (-0.84) and body length versus heart girth (-0.91) for rabbits fed fresh pawpaw leaves. Positive correlation was observed for rabbits fed wilted pawpaw leaves. This observation is in line with the findings of Akanno and Ibe (2006), Chineke (2000) and Tiamiyu et al. (2000) who reported positive relationships between live weight and body dimensions in rabbits stating that, increase in body weight was as a result of an increase in linear body measurement.

Conclusion

In conclusion, fresh pawpaw leaves can be more utilized by weaner rabbits as feed supplement with concentrate compared with wilted pawpaw leaves without adverse effects on their growth performance and linear body parameters.

CONFLICT OF INTEREST

The authors declare that they have no competing interests

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