Short Communication

Growth performance of growing rabbits fed graded levels of *Acacia Albida* Pods.

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Abstract

The effect of feeding up to 40% of *Acacia albida* pods (AAP) on the growth performance of growing rabbits was investigated. Sixty crossbred (Dutch x New Zealand white) rabbits; 7-8 weeks old were used for the 12-week study. The rabbits were individually weighed and assigned to the 5 diets in groups of 12 rabbits per treatment. The experimental diets contained 0, 10, 20, 30 and 40% AAP in diets 1, 2, 3, 4 and 5 respectively. The crude protein and energy levels of the diets were maintained at 18% and at least 3100 kcal/kg respectively. The diets and drinking water were offered ad libitum. The crude fibre (CF) of the diet ranged from 11.22% in diet 1 to 14.84% in diet 5. The CF levels appreciated with increasing levels of AAP. A similar trend was observed for ether extract (4.78 to 6.90%), tannins (0.099 to 1.09%) and phytins (128.58 to 285.71 mg). Feed intake did not differ significantly ($P > 0.05$) among the groups on diets 1 (57.80g), 2 (55.89g), 3 (58.53g) and 4 (55.92g) but was significantly ($P < 0.05$) lower for those on diet 5 (53.07g/d). Weight gain, feed conversion ratio (FCR) and protein efficiency ratio (PER) of rabbits on all the diets did not differ significantly ($p > 0.05$), though rabbits on diet 5 had slightly lower daily weight gain which cumulated into significantly lower final body weight of 1389.16g compared to 1605.83g for diet 1. Daily weight gain, FCR and PER were better in the first eight weeks compared to weeks 9 to 12. The corresponding values were 9.63 to 12.68 Vs 2.14 to 3.70g/d for daily weight gain, 4.73 to 5.78 Vs 14.22 to 22.11 for FCR and 0.90 to 1.20 Vs 0.23 to 0.41 for PER. Thus, 20% AAP can be included in diets of rabbits without adverse effect on biological performance.

Key words: Growing rabbits, *Acacia albida* pods, Performance.

Introduction

The use of non-conventional feed (NCF) for feeding minilivestock has been suggested as one of the ways of making the rearing of such animals (e.g. rabbits, guinea pigs etc.) affordable and popular (Raharjo *et al.*, 1988). The use of NCF is advantageous since they are cheap and easy to procure. An example is *Faidherbia albida* (*Acacia albida*) pod, a feed resource that is

readily available during the dry season in the semi arid areas of Nigeria. The pod which is obtained from *Acacia* tree enjoys a prime position in feeding small ruminants during the dry season (Mohammed, 1996; Tanner *et al.*, 1990).

Acacia albida is a large tree and plays a significant role in subsistence agriculture in the Sudan and Sahelian zones of the country. They

constitute the dominant tree in most farmlands in this region. The plant is unique for its inverted phenology which signifies that it remains leafless in the rainy season but produces pods and fresh foliage during the dry season when feed is scarce. This peculiar feature permits farmers to grow crop around the *acacia* tree without cutting the branches, and in the dry season, the pods and foliage provide livestock with valuable feed.

Toutain (1980) reported that the pods are gathered by hand for household animals and are also bought and sold in the market. He also reported the digestible protein in g/kg of dry matter for the whole pods and green foliage as 70g and 103g respectively.

Similarly, preliminary studies (Igwebuike *et al.*, 2003) indicated that growing rabbits could tolerate up to 20% treated and untreated *Acacia* pods in their diets without adverse effects on their performance. Abu *et al.* (1997) evaluated the nutritional qualities of the pod and recommended the complete replacement of maize offal with *Acacia albida* pods (AAP) in rabbit's diets.

The present study was designed to determine the growth performance of growing rabbits fed diets containing graded levels of AAP up to 40%.

Materials and Methods

Experimental site

The experiment was conducted at the University of Maiduguri, Livestock and Research Farm, Maiduguri, Borno State, Nigeria. Maiduguri town is situated between latitude 11° 51' and 12° North, longitude 13° 05' and 14° East and at an altitude of 354m above sea level. Maiduguri falls within the Sahel region and is characterized by a short rainy season (June to September) and a long dry season (October to May). Ambient temperature could be as high as 40°C or more in April.

Procurement and processing of Acacia albida pods.

The *Acacia albida* pods were obtained from the vicinity of the University of Maiduguri, Maiduguri, Borno State, Nigeria. The pods were sun dried on concrete floors, chopped into small bits and ground.

Experimental diets

The composition of the experimental diets and whole *Acacia albida* pods is shown in Table 1. The dried *Acacia albida* pods (AAP) were ground and incorporated at levels of 0, 10, 20, 30 and 40% in diets 1 (control), 2, 3, 4 and 5 respectively. The protein content of the diets were maintained at about 18% while each diet contained at least 3100kcal/kg of metabolisable energy (ME) calculated according to the formula of Ponzenga (1985) given as:

$ME(Kcal/Kg) = 37 \times \%CP + 81 \times \%EE + 35.5 \times \%NFE$.

Where, CP = Crude protein,

EE = Ether extract and

NFE = Nitrogen-free extract.

The chemical compositions of the diets were determined by the methods of AOAC (1980).

Experimental animals and design

Sixty crossbred (Dutch x New Zealand white) rabbits between 7 and 8 weeks old with an average liveweight of 790.09g were divided into 5 groups of 12 rabbits each. They were housed individually in wire netting cages and used for the study which lasted 12 weeks (84 days). The rabbits were given the experimental diets and clean drinking water *ad libitum* throughout the experimental period.

Data collection and analysis

Feed intake was recorded daily while rabbits were weighed weekly to determine weight gain. The average daily gain, feed conversion ratio and protein efficiency ratio were calculated. The protein efficiency ratio (PER) was calculated thus:

Gain in Body Weight (g)
 PER = Protein Consumed (g)

Data were collected over two periods (weeks 1-8 and weeks 9-12) and subjected to analysis of variance and where significant differences were detected, means were separated by Duncan's multiple range test (Steel and Torrie, 1980).

Results

The chemical composition of the experimental diets is presented in Table 1. The crude protein (CP) content of the diets was approximately 18%, a level adequate to meet the needs of growing rabbits. The crude fibre (CF) levels ranged from 11.22% in diet 1 (0% AAP) to 14.84% in diet 5 (40% AAP). The CF levels appreciated with

increasing levels of AAP in the diets. Similarly, the ether extract (EE) (4.78 to 6.90%), tannins (0.099 to 1.09%) and phytins (128.58 to 285.71 mg/100g) levels of the diets also increased with increasing levels of AAP in the diets. The calculated energy levels of the diets were between 3148.76 and 3287.56 kcal/kg diet. The calcium and phosphorus levels were between 0.99 and 1.29% and 0.60 and 0.84% respectively.

The feed intake, weight gain, feed conversion ratio and protein efficiency ratio of rabbits fed the various dietary levels of AAP are shown on Table 2. During the first eight weeks of the study, rabbits on diet 3 (20% AAP) recorded the highest feed intake (62.86g/d), which was significantly ($P < 0.05$) different from the intake of rabbits on

Table 1: Ingredients and chemical composition of the experimental diets and AAP.

Ingredients (%)	Diets					Whole AAP
	1	2	3	4	5	
Maize	41.93	35.41	29.21	22.97	16.57	-
AAP ¹	0.00	10.00	20.00	30.00	40.00	-
Maize bran	20.00	15.00	10.00	5.00	0.00	-
Groundnut haulms	10.00	10.00	10.00	10.00	10.00	-
Groundnut cake	24.92	25.44	25.64	25.88	26.28	-
Palm oil	0.00	1.00	2.00	3.00	4.00	-
Bone meal	2.50	2.50	2.50	2.50	2.50	-
Salt (NaCl)	0.50	0.50	0.50	0.50	0.50	-
Premix*	0.15	0.15	0.15	0.15	0.15	-
Total	100.00	100.00	100.00	100.00	100.00	-
Analyzed Chemical composition (%)						
ME(Kcal/kg) ²	3239.45	3287.56	3212.99	3184.54	3145.76	-
Dry matter	94.60	95.40	95.40	95.20	95.20	93.50
Crude protein	18.12	18.10	17.94	17.64	18.14	12.37
Crude fibre	11.22	11.87	12.42	13.15	14.84	11.18
Ether Extract	4.78	6.47	6.74	6.78	6.91	2.49
Ash	4.42	4.58	6.47	6.58	6.14	2.26
Nitrogen-free extract	61.46	58.98	56.43	55.85	53.94	71.80
Calcium (Ca)	1.06	0.92	1.21	1.29	1.15	0.45
Phosphorus (P)	0.60	0.60	0.84	0.74	0.65	0.13
Ca : P ratio	1.77	1.53	1.44	1.74	1.77	-
Energy : protein ratio	210.46	213.19	210.43	212.39	205.45	-
Tannins (%)	0.09	0.23	0.53	0.73	1.09	0.42
Phytins (mg/100g)	128.88	142.86	142.86	182.15	285.71	142.86

*AAP = *Acacia albida* pods

²ME = Metabolisable energy (calculated according to Pauzenga, 1985)

*Premix (VitaDIZ B.P.) manufactured by DIZPHARM (NIG). LAGOS.

Supplying the following per kg: Vitamin A, 6250000IU; Vitamin D₃, 1250000IU; Vitamin E, 15000IU; Vitamin K, 1,250mg; riboflavin, 3660mg; pantothenic acid, 500mg; pyridoxine, 1750mg; vitamin B₁, 1000mg; niacin, 15000mg; vitamin B₁₂, 10mg; biotin, 25mg; folic acid, 500mg; choline chloride, 150g; antioxidant, 62.5g; iron, 50g; manganese, 50g; Zn, 50g; iodine, 0.78g; cobalt, 0.25g; selenium, 0.05g; copper, 5.0g

Table 2: Performance characteristics of rabbits fed graded levels of *Acacia Albida* pods.

Parameters	Diet/ treatment number					SEM
	1	2	3	4	5	
	Dietary levels of AAP ¹ (%)					
	0	10	20	30	40	
No of rabbits	12	12	12	12	12	-
Period: weeks 1 to 8:						
Average daily						
Weight gain (g)	12.68	12.17	12.65	11.35	9.63	1.02 ^{ns}
Average daily						
Feed intake (g)	60.03 ^b	59.11 ^b	62.86 ^a	59.44 ^b	55.62 ^c	0.85*
Feed conversion						
ratio/feed/gain)	4.73	4.85	4.97	5.24	5.78	0.76 ^{ns}
Protein efficiency						
ratio	1.20	1.14	1.11	1.06	0.98	0.09 ^{ns}
Period: weeks 9 to 12:						
Average daily						
Weight gain (g)	3.75	3.63	3.42	2.14	2.17	0.60 ^{ns}
Average daily						
Feed intake (g)	53.35 ^a	49.43 ^b	49.89 ^b	48.90 ^b	47.97 ^b	1.07*
Feed conversion						
ratio(feed/gain)	14.22	13.62	14.59	22.85	22.11	4.76 ^{ns}
Protein efficiency						
ratio	0.41	0.41	0.41	0.23	0.24	0.07 ^{ns}
Period: weeks 1 to 12:						
Mean initial body	790.42	790.00	789.17	791.67	789.17	34.32 ^{ns}
weight (g)						
Mean final body	1605.83 ^a	1573.33 ^a	1593.33 ^a	1489.50 ^{ab}	1389.16 ^b	42.68*
weight (g)						
Average daily	9.71	9.33	9.57	8.28	7.14	0.69 ^{ns}
Weight gain (g)						
Average daily	58.80 ^a	55.89 ^b	58.53 ^a	55.93 ^b	53.07 ^c	0.73*
Feed intake (g)						
Feed conversion	5.95	5.99	6.12	6.57	7.43	1.79 ^{ns}
ratio(feed/gain)						
Protein efficiency	0.93	0.90	0.88	0.78	0.73	0.06 ^{ns}
ratio						
Mortality (number)	0	0	0	0	0	-

¹AAP – untreated *Acacia albida* pods

SEM – standard error of means

a,b,c - means on the same rows bearing different superscript differ significantly (P<0.05)

ns – Not significant (P>0.05)

* – Significant (P<0.05)

diets 1, 2, 4 and 5. However, intake of rabbits on diet 5 was inferior to those on diets 1, 2 and 4 which did not differ significantly ($P>0.05$) amongst the treatments. During weeks 9 to 12, rabbits on diet 1 significantly ($P<0.05$) consumed more feed than the other treatments which did not differ from one another. When the entire experimental period was considered (Table 2), the feed intake of rabbits on diets 1, 2, 3 and 4 did not differ significantly ($P>0.05$) from one another, but were significantly ($P<0.05$) higher than those on diet 5 which recorded an average daily feed intake of 53.07g.

The weight gains of rabbits in all the treatments during the first eight weeks were not significantly different despite the slightly lower value of rabbits on diet 5. The same pattern was observed during the last 4 weeks (weeks 9 to 12) of the study. The daily weight gain were severely depressed during this period (weeks 9 to 12) being 2.14 to 3.70g/d compared to 9.63 to 12.68g/d during the first 8 weeks as shown in Table 2. The weight gains for the entire experimental period did not differ significantly ($P>0.05$) among the treatments. The slightly lower daily weight gain of rabbits on diet 5, cumulated to the significantly ($P<0.05$) lower final weight of rabbits as shown in Table 2. The feed conversion ratio did not differ significantly among the treatments during the first 8 weeks of the experiment. The same trend was observed during the last 4 weeks and the entire experimental period of 12 weeks. However, the rabbits made more efficient use of their feed during the first eight weeks of the experiment. This period, which was the period of maximum daily gain, coincided with the period of highest feed conversion ratio (FCR). The deterioration in the FCR noticed towards the end of the experiment was due to the inefficient gain of the rabbits during the last 4 weeks of the experiment.

There was no significant ($P>0.05$) difference in protein efficiency ratio (PER) among the treatment though rabbits on diets 1, 2 and 3 were numerically better. The PER was better in the first eight weeks when there was rapid growth than in the last 4 weeks when growth was tapering off.

Discussion

The crude protein (CP) content of the diets (approximately 18%) and calculated energy levels shown in Table 1 were sufficient to meet the requirements of growing rabbits in a tropical environment as reported by other workers (Anugwa *et al.*, 1982; Adegbola, 1991). The crude fibre levels (11.22 to 14.84%) which appreciated with increasing levels of untreated AAP in the diets compared favourably with the range of 12 to 14% (Aitken and Wilson, 1962) and 10 to 15% (De Blas *et al.*, 1986) reported as optimal for growth of young rabbits. The increase in the levels of ether extract (EE) with increasing levels of AAP in the diets might be due to the use of palm oil to balance the energy contents of the diets. Cheeke (1987) reported that the minimum level of 3% is desirable to provide essential fatty acids and to maintain a glossy sleek hair coat in growing rabbits. Lebas (1980) also recommended calcium and phosphorus levels of 0.5 and 0.3% respectively for growing rabbit, which were met by the diets.

Tannins are known to lower feed intake, reduce growth rate and nutrient digestibility (Jansman, 1993) while phytic acid on the other hand lowers the bioavailability of minerals and inhibit enzymatic digestion of ingested proteins (Nolan and Duffin, 1987) if their threshold levels are exceeded. With respect to tannins, only diets 4 and 5 had levels higher than the 0.5% threshold level for chicks (Jansman, 1993). However, the threshold level for rabbits is not yet known but it

is believed that they may tolerate higher levels than other monogastrics due to their ability to secrete proline-rich protein which have high binding affinity for tannins (Butler *et al.*, 1986). Similarly, Cheeke *et al.* (1987) reported that rabbits are less sensitive to phytins than poultry and swine with a 50% bioavailability of phytin phosphorus. The significantly ($P < 0.05$) lower feed intake of rabbits on diet 5 compared to the control and other diets contradicts what was reported in previous studies (Alawa and Amadi, 1991; Igwebuike *et al.*, 1995). These authors observed enhanced feed intake in high fibre diets, which was interpreted as an attempt by the rabbits to compensate for the lower energy levels of the high fibre diets. This might, however, not be the case in this study, since effort was made to balance the energy levels of the diets by using various levels of palm oil. Thus, the low feed intake of rabbits on diet 5 may be attributed to the adverse interaction between high ambient temperature and consumption of high fibre diets. Preston (1987) observed that the depressing effect of high environmental temperature on feed intake is exacerbated by high fibre diets which generate more heat when metabolized and the net effect is further reduction in feed intake as observed in diet 5. In addition, the adverse effect of tannins on feed intake cannot be overlooked. The better weight gain of rabbits during the first 8 weeks of the experiment and the subsequent decline in the weight gain from weeks 9 to 12 confirms the observation by Asuquo (1993) that growth rate is higher in young than older rabbits after feeding a mash and pelleted diet to rabbits. He observed that inflection point for body weight gain was reached at 14 weeks of age, with a decline thereafter. The average daily gain recorded at the end of the 12-week experimental period (7.14 to 9.71g/rabbit/day) were close to 9.37 to 9.80g/d reported by Igwebuike *et al.* (1995) for rabbits reared in the tropical countries but slightly higher than 5.0 to 6.3g/d reported by Abu *et al.* (1999) for young rabbits in semi arid

environments. The relatively low weight gain of rabbits in this study may be due to the reduced feed intake. This view was corroborated by Anugwa *et al.* (1982) who linked low weight gain to relatively low feed consumption arising from feeding of meals instead of pellets to growing rabbits. As shown in Table 2, the rabbits made more efficient gain during the first 8 weeks than the last 4 weeks of this experiment. Similarly, they grew more rapidly during this period. This agrees with the observation of Cheeke (1987) who reported that rabbits make more efficient use of the feed during periods of rapid weight gain with subsequent decline after 12 weeks of age.

The protein efficiency ratio (PER) followed a trend similar to the feed conversion ratio (FCR). The PER (0.98 to 1.20) obtained during the first eight weeks were better than the last 4 weeks and compared favourably with the values (1.04 to 1.20) reported by Onifade and Tewe (1993) for rabbits of similar ages. The inferior values (0.23 to 0.41) during the last 4 weeks were in line with the lower weight gain and poor FCR recorded during this period. The overall PER (0.73 to 0.90) at the end of the experiment (12 weeks) fell within the range of (0.47 to 1.0) reported by Adegbola (1991) for rabbits above 14 weeks of age, thus confirming the adverse influence of age on PER.

From the results presented in Table 2, it could be observed that 87 to 91% of the weight gain was during the first 8 weeks of the experiment while 69 to 73% of the total feed consumed was used to achieve this.

Conclusion

It can be concluded from this study, that rabbits for meat could be slaughtered or sold after 14 to 16 weeks of age, though other market considerations such as the production of heavier

and mature rabbits may entail the extension of the rearing period beyond this point. On the basis of the comparable weight gain of rabbits on diets 1 (0% AAP) and 3 (20% AAP), rabbits meant to be marketed at 14 to 16 weeks of age and above can tolerate up to 20% AAP in their diets without adverse effects on their performance.

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