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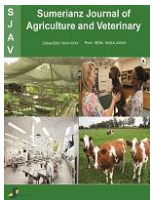

Original Article Open Access

Feeding Value of Tiger Nut (*Cyperus Esculentus*) Meal for Growing Rabbits

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Abstract

Aim/background: A feeding trial was conducted to investigate the feeding value of tiger nut meal for growing rabbits. Methods: Ninety six Chinchilla and New Zealand crossbred rabbits of mixed sexes were randomly allotted to six treatment groups in a Completely Randomised Design experiment; each group was replicated twice with eight rabbits per replicate. Six diets were formulated such that diets 1, 2, 3, 4, 5 and 6 contained 0, 8, 16, 24, 32 and 40% tiger nut meal respectively. The crude protein content of the diets was between 17.74 and 18.33% while ether extract was between 4.89 and 14.44%. Growth performance parameters and carcass characteristics were determined appropriately. Results: Feed intake, weight gain, feed conversion ratio, spleen and liver weight and nutrient retention showed significant differences (P 0.05) between dietary treatments. Feed intake, live weight and weight gain all increased with an increase dietary level of tiger nut meal up to 24% inclusion level beyond which depression occurred. The best feed conversion ratio was obtained for rabbits on the control and 16% dietary level of tiger nut meal. The highest protein retention was obtained for rabbits fed diets containing tiger nut from 0 – 16% level. The spleen and liver weight increased (P 0.05) with increasing level of tiger nut meal. Conclusion: The study concluded that 16% tiger nut meal can be included in diets meant for growing rabbit without compromising growth performance, nutrient digestibility and carcass characteristics.
Keywords: Nutrient retention; Performance; Rabbit; Tiger nut.

1. Introduction

The search for lesser known and under- utilised crops as animal feed has been intensified to maintain a balance between population growth and agricultural productivity. This is particularly common in the tropical and sub-tropical areas of the world. The development has prompted the need to harness the potentials of lesser feedstuffs as part or total replacement for more expensive ones [1-4]. The alternative feed ingredients should be available all year round, easy to procure and processed into usable forms and must have comparative cost advantage over the conventional feedstuffs [5]. More so, such feedstuffs must not be staple items of human food [6].

A species that can be exploited in this manner is Cyperus esculentus commonly called tiger nut. It is an under-utilised crop which belongs to the family Cyperaceae. It possesses vital agronomic and nutritional potentials as the conventionally used energy sources. There are two main varieties of tiger nut; the yellow and the brown varieties in Nigeria. The yellow variety is preferred to all other varieties because of its inherent properties including its bigger size, attractive colour, fleshier body, more milk content, lower fat, and high protein and possesses less anti-nutritional factors especially polyphenols [7].

In Nigeria, Tiger nut can be grown almost everywhere in the country; the Cross River State Government encourages the cultivation of tiger nut in order to control erosion and to improve the aesthetic value of the green environment [8]. In Northern Nigeria, tiger nut residue (after milk extraction) is often discarded by the beverage industries as waste. Recent studies indicated that residue or the whole plant is high in energy, fair in amino acids composition with little or no-tolerable allergens and serves as a useful ingredient in livestock feeds [9, 10].

There is paucity of information on the effect of tiger nut meal in rabbits. This study was therefore designed to investigate the performance, carcass characteristics and nutrient digestibility of rabbits fed diets containing different levels of tiger nut meal.

2. Materials and Methods

2.1. Experimental Site

The experiment was carried out at the Rabbitry Unit of the Teaching and Research Farm, University of Calabar, Calabar in Southern Nigeria; which falls between latitude $4^{\circ}57^{1}$N and longitude $8^{\circ}19^{1}$E with mean annual rainfall

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between 1260 and 1280 mm, average daily temperature between 25 and 30°C with a relative humidity of 70 – 90% at an elevation of 99 m above sea level.

2.2. Experimental Design

Ninety-six weaned rabbits of New Zealand White and Chinchilla crossbred and mixed sexes of about six weeks of age were used in this study. The initial weight ranged between 509.20 and 514.13 g. The rabbits were randomly assigned to six treatments of eight rabbits each and two replicates of four rabbits (2 bucks and 2 does) in a completely randomized design experiment.

2.3. Experimental Diets

The yellow sundried tiger nuts were purchased in jute bags from Jos, Plateau State, Nigeria and further sun-dried by spreading them on a concrete slab for three days after which they were milled with a Meadows model 35 harmer mill and sieved through a mesh of 5mm to produce the meal. It was then subjected to chemical analysis. The meal was then incorporated in the experimental diets as shown in Table 1. Diet 1 served as the control with 0% tiger nut meal while diets 2, 3, 4, 5 and 6 had 8, 16, 24, 32 and 40% tiger nut meal respectively.

Table-1. Gross composition of experimental diets

Ingredients (%)	**T_1 0 % tiger nut**	**T_2 8% tiger nut**	**T_3 16% tiger nut**	**T_4 24% tiger nut**	**T_5 32% tiger nut**	**T_6 40% tiger nut**	**Test ingredient (tiger nut meal)**
Maize	50.00	43.00	36.00	29.00	22.00	15.00	
Tiger nut meal	0.00	8.00	16.00	24.00	32.00	40.00	
Soybean meal	22.00	23.00	24.00	25.00	26.00	27.00	
Wheat offal	15.30	13.30	11.30	9.30	7.30	5.30	
Palm kernel cake	8.20	8.20	8.20	8.20	8.20	8.20	
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	
Oyster shell	1.50	1.50	1.50	1.50	1.50	1.50	
∗Vit./min. premix	0.50	0.50	0.50	0.50	0.50	0.50	
Total Calculated analysis:	100.00	100.00	100.00	100.00	100.00	100.00	
Crude protein (%)	18.75	18.57	18.39	18.20	18.03	17.85	
Crude fibre (%)	9.60	9.68	9.72	9.80	9.89	9.96	
ME(Kcal/kg)	2560.60	2556.12	2531.35	2518.90	2490.66	2474.25	
Determined analysis (%):							
Crude protein	18.33	18.19	18.06	17.91	17.88	17.74	5.05
Crude fibre	9.44	9.49	9.68	9.89	10.23	10.44	13.05
Ether extract	4.89	6.48	8.70	10.92	12.21	14.44	26.99
Ash	3.77	4.62	4.90	5.32	5.94	6.50	11.67

*****Premix (Agricare-mix) contained Vit A, D_3, K, B_{12}, Riboflavin, Pantothenic and Folic Acid, Iodine, Copper, Zinc, Terramycin, Anti-oxidant and anti-caking agent.
ME represents metabolisable energy

2.4. Chemical Analysis

The proximate compositions of the test ingredient, diets and faecal samples were determined according to AOAC [11].

2.5. Animal Management

Two rabbits were housed in each wooden cage made of wire mesh floor with pans under for faecal and urine collection. Prior to these; the hutches were cleaned, washed and disinfected properly. Water and feed were given ad libitum and all the animals were given three hours free access to Panicum maximum on a daily basis. On the seventh week, faecal samples were collected for six days, oven dried at 80º for 48 hours and stored in sample bottles for digestibility studies. The experiment lasted for 10 weeks.

2.6. Statistical Analysis

All data were subjected to one way analysis of variance (ANOVA) [12]. Significant means were separated using Duncan's Multiple Range Test [13].

3. Results and Discussion

The proximate composition of tiger nut meal as shown in Table 1 revealed that it contains 5.05% crude protein which is very low when compared to other fibre feedstuffs as reported by Aduku [14]. However, it has a higher level of fat (ether extract) between 23.72 and 25.78% and which according to Fanimo, *et al.* [15], could be affirmed to be a good source of energy.

As shown in Table 2, the mean daily feed intake of rabbits over the experimental period differed significantly ($P < 0.05$) across the dietary treatments and tended to increase as the levels of tiger nut meal increased up to 24% level but significantly ($P > 0.05$) decreased above this level. The initial increment in feed consumption agrees with the reports of Lebas, *et al.* [16]; Adejinmi, *et al.* [17], that high fibre in rabbit diet increases feed intake to allow rabbits meet their dietary components other than energy. However, this was not applicable when the level of tiger nut meal exceeded 24% in the diet. The observed depression could be attributed to other factors apart from fibre. For example anti-nutritional factors which increased with dietary level of tiger nut meal. Nsa, *et al.* [18], had earlier reported low feed consumption by birds fed processed castor seed meal and attributed it to the content of anti-nutritional factors. Archibong, *et al.* [8], reported that tiger nut meal is relatively high in oxalate and tannin, thus when included in diets at high levels could depress feed intake.

Table-2. Performance and carcass characteristics of growing rabbits fed diets containing graded levels of tiger nut meal

Parameters	**T_1 0 % tiger nut**	**T_2 8% tiger nut**	**T_3 16% tiger nut**	**T_4 24% tiger nut**	**T_5 32% tiger nut**	**T_6 40% tiger nut**	**SEM**
Initial weight (g/rabbit)	514.13	516.00	509.20	510.65	511.00	509.95	2.94
Daily feed intake (g/rabbit)	70.12^{b}	73.66^{ab}	76.41^{ab}	79.91^{a}	69.41^{b}	57.66^{c}	1.88
Daily weight gain (g)	14.00^{b}	14.18^{b}	15.00^{a}	15.50^{a}	12.82^{c}	10.44^{c}	0.42
Final live weight (g)	1306.12^{b}	1329.01^{b}	1364.07^{a}	1388.25^{a}	1296.00^{c}	1100.48^{d}	5.61
Feed conversion ratio	5.01^{d}	5.19^{c}	5.09^{d}	5.16^{c}	5.41^{b}	5.52^{a}	0.10
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carcass evaluation:							
Dressing percentage (%)	57.78^{a}	57.82^{a}	57.86^{a}	58.00^{a}	55.41^{b}	54.06^{b}	1.18
Lungs weight (% LW)	0.70	0.68	0.64	0.63	0.59	0.57	0.05
Kidney weight (%LW)	0.66	0.67	0.65	0.68	0.66	0.69	0.01
Liver weight (%LW)	1.80^{c}	1.81^{c}	1.90^{b}	1.95^{ab}	1.99^{a}	2.02^{a}	0.02
Spleen weight(%LW)	0.03^{c}	0.03^{c}	0.06^{b}	0.06^{b}	0.09^{a}	0.09^{a}	0.01
Heart weight (% LW)	1.10	1.11	1.10	1.13	1.13	1.12	0.02
Nutrient retention (%):							
Dry matter	40.98	40.16	40.28	39.46	39.32	39.18	1.77
Crude protein	52.66^{a}	52.19^{a}	52.01^{a}	50.62^{b}	41.12^{c}	32.09^{d}	2.01
Crude fibre	50.41	50.35	49.35	48.69	46.15	46.00	2.56
Ether extract	61.21^{d}	62.44^{c}	63.98^{b}	65.70^{a}	65.92^{a}	66.02^{a}	6.13
Ash	51.04^{f}	53.72^{e}	55.21^{d}	57.66^{c}	59.21^{b}	62.44^{a}	7.01
Nitrogen free extract	39.45	39.38	38.61	37.59	35.15	35.11	1.92

^{a,b,c}Means along the same row with different superscripts are significantly ($P<0.05$) different

The average final weight and average daily weight gain of rabbits increased significantly ($P < 0.05$) with increasing levels of tiger nut meal in the diets up to 24% inclusion level. The observed initial increase could be due to improve in feed intake which transformed to increase in live weight and weight gain [19, 20]. The subsequent depression in weight of rabbits beyond 24% inclusion level of tiger nut meal could be attributed to the high content of anti-nutritional factors which increased with increasing dietary levels. The presence of these anti-nutritional factors has been proven to reduce growth rate of livestock due to reduce protein and specific amino acids utilisation [21, 22]. Similarly, increase in dietary level of tiger nut meal means increase in dietary fibre, though high dietary fibre increased feed intake to meet dietary needs for energy and other nutrients, excessive level of fibre as revealed by the proximate composition of tiger nut meal (27.82%) could equally impair feed utilisation and consequently growth rate [18, 23].

The best feed conversion ratio was obtained on rabbits in the control diet and 16% tiger nut level of inclusion. An indication that 16% dietary level of tiger nut improves feed utilisation similar to the control diet. The least feed utilisation was obtained on rabbits fed diets containing 40 % inclusion level of tiger meal.

Among the carcass and internal organs parameters measured, only the weight of spleen and liver showed significant ($P<0.05$) differences. They both tended to increase significantly ($P < 0.05$) with dietary tiger nut level. This result is in consonance with that of Nsa, *et al.* [18], who reported that the spleen and liver were the target organs for fat and fibre digestion. The liver is also the primary target organ of toxic factors and that haemagglutinin activity still remains high at 24% and above level of tiger nut inclusion [24]. This extra load must have put more pressure on these organs making them to enlarge for effective exhaustion of this task.

The nutrient retention estimate showed significant differences apart from dry matter, crude fibre and nitrogen free extract. Levels above 16% tiger nut meal in the diet depressed crude protein digestibility. The trypsin inhibitor and haemagglutinin are implicated for the inhibition of protein metabolism. The improvement in the ether extract and ash contents as the inclusion level increased in the diets could be attributed to the high content of these nutrients in tiger nut meal [21].

4. Conclusion

The study concludes that rabbits fed 16% tiger nut meal (diet T_3) had overall best performance in terms of live weight, weight gain and feed utilisation. It is therefore recommended that 16% tiger nut meal should be included in diets meant for rabbits for improved performance, nutrient digestibility and carcass characteristics.

Authors' Contributions

Essien Ekpenyong Nsa: Designed the conceptual framework of the research work, actively involved in the feeding trial, developing of the background of the study and literature search of useful materials for the work.

Pascal Ogar Ozung: Developed the methodology of the research work, also participated in the feeding trial, laboratory and statistical analyses and result presentation as well as checking grammatical errors and general editing of the research paper.

Emmanuel Ekpo Archibong: He was also actively involved in the feeding trial, developed the Discussion aspect and cross checked all references cited in this research paper as well as editing the write up.

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