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Growth Performance and Nutrients Digestibility of Weanling Rabbits Graded Levels of Sesame Seed Meal (*Sesamum Indicum*) in Semi-Arid Region of Nigeria

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ABSTRACT

An experiment was conducted to determine the effects of various levels of sesame seed meal inclusion on the performance and apparent nutrient digestibility of weanling rabbits. Sixteen, (New Zealand White) rabbits of mixed sexes were used for the experiment. They were weighed and randomly allotted to four dietary treatments with four rabbits per treatment. The levels of sesame seed meal in T_1, T_2, T_3 and T_4 were 0, 4, 8, and 12% respectively. The diets and clean water were offered *ad libitum* throughout the experimental period of 63 days. The parameters measured were feed intake, live weight gain. Feed conversion ratio (FCR) and apparent nutrient digestibility. Rabbits on treatment 3 significantly ($p<0.05$) consumed more feed than those on treatments 1, 2, and 4. The highest (54.48g/day) and the lowest (46.70g/day) feed intake were recorded in T_3 (8%) and T_1 (0%) respectively. The live weight gain and FCR were significantly different ($p<0.05$) better in diets 2, 3 and 4 than the control (T_1). There were significant difference ($p<0.05$) among treatment for apparent digestibility of nutrient. The dry matter, crude fibre, crude protein, ether extract and ash were inferior in the control (0% sesame meal) than the other treatment. Based on these results, growing rabbits could tolerate 12% sesame meal in their diets without adverse effects on their performance.

Key words: Growth, nutrients digestibility, rabbits and sesame seed meal

INTRODUCTION

Animal protein is very essential for meeting the protein requirement of man. The levels of meat and animal protein consumption was estimated at 8.27 g per caput per day, which was about 20 g less than the animal protein requirement recommended by the National Research Council of the United States of America (FAO. 1997). Large animals because of slow production cycles, cannot easily meet such increases in demand. Small animals such as rabbits, poultry and pigs may meet this. Increase rabbit production could bridge the supply-demand protein gap, for subsistence protein production. Compared with the meat of other small livestock species, rabbits meat is richer in protein, certain vitamins and minerals. It contains little fat and higher proportion of essential polyunsaturated linolenic and linoleic fatty acids. Sesame seed (*Sesamum indicum*) also known as benniseed contains 25% crude protein (Asogwa *et al*., 2005) and about 50% oil (Anon., 2006). They are highly valued for their oil, which is exceptionally resistant to rancidity (Kamal-Eldin *et al*., 1995). Sesame seed is a good source of manganese and copper, they are also good source of calcium, magnesium, iron, phosphorus, vitamin B_1, zinc and dietary fibre. Sesame seed has been shown to contain phytosterols which are found in plants. Phytosterols have a chemical structure very similar to cholesterols and when present in diets in sufficient amounts are believed to reduce blood levels of cholesterols, enhance the immune response and decrease risk of certain cancers (Hirata *et al*., 1996). Sesame seed contains toxic substances, which limit its use in monogastric animal feed. Philips *et al*.(2005) reported that the seed contains phytic and oxalic acids, which are anti metabolites. However, the nutritive value of sesame seed could compare favorably with that of groundnut cake once the anti-nutritional factors are reduced or eliminated by heat treatment. The objectives of this study therefore is to determine the effects of sesame seed meal on the performance, nutrient digestibility and economic performance of weanling rabbits.

MATERIAL AND METHODS

Sixteen weanling rabbits (New Zealand White) with age ranging from 5 to 6 weeks were randomly selected and assigned to four dietary treatment groups with four rabbits per treatment. Rabbits were housed in cages

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measuring 45 cm × 30 cm × 42 cm. Before the commencement of the experiment the rabbits were precondition by deworming them with albendazole® and administering prophylactic doses of coccidiostat (coccinor®) and Ivomce® for controlling coccidiosis and mange respectively. The four experimental diets as shown in Table 1contain 0, 4, 8, and 12% sesame seed meal in treatment 1 (control), T_2, T_3 and T_4 respectively. The sesame seed replaced groundnut cake in the diets. The sesame seed was procured from Gwoza market in Gwoza local Government Area of Borno State, Nigeria. The seeds were toasted for 15 minutes in an open wide aluminum pan mixed with clean fine sand to prevent the burning of the seed coat and enhance even distribution of heat. Sand was then sieved from the seeds and allowed to cool. Thereafter, the seeds were milled for incorporation into the diets. The sesame seed meal (SSM) so prepared was used to formulate four treatment diets. The experimental diets and drinking water were offered to the rabbits *ad libitum* throughout the experimental period of nine weeks (63 days). Data on daily feed intake and live-weight gain were collected. The rabbits were weighed initially and subsequently on weekly basis. Feed intake was measured on daily basis while feed conversion ration was calculated. A digestibility study was carried out at the last week of the experiment. Faecal samples were collected from 3 rabbits per treatment in order to determine apparent nutrient digestibility.

Table 1. Composition of the experimental diets

	Treatments			
Ingredients (%)	T_1	T_2	T_3	T_4
White maize	38.35	38.35	38.35	38.38
Groundnut cake	12.00	8.00	4.00	0.00
Sesame seed meal	0.00	4.00	8.00	12.00
Groundnut haulms	18.00	18.00	18.00	18.00
Maize bran	24.00	24.00	24.00	24.00
Fish meal	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50
*Premix	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00

Composition of Premix (Bio-mix) Supply the following per kg diets. Vitamin A. 500,000 IU Vitamin D. 800.00 IU, Vitamin E. 12.000 mg. Vitamin K, 5000 mg, Vitamin B, 1000 mg, Vitamin B, 2000 mg, Vitamin B_6,15000 mg, Niacin, 12,000 mg, Panthothenic acid, 20.00 mg, Biotin 10,000 mg. Vitamin B_{12}, 30.000 mg. Folic acid, 150.000 mg. Chloride 60.000 mg, Manganese 10.000 mg, Iron. 15000 mg zinc 80.000 mg. Copper 400 mg, Iodine. 80,000 mg Cobalt 40 mg. Selenium 8,000 mg.

Chemical analysis

The experimental diets, Sesame seed meal and faecal samples were analyzed for dry matter (DM), crude fibre (CF), crude protein (CP), ether extract (EE), and ash according to AOAC (2002) methods.

Statistical analysis

Data collected were subjected to analysis of variance (ANOVA) using the randomized block design. Significant difference ($p<0.05$) among treatment means were determined by the least significant difference (LSD) (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Proximate composition of experimental diets

The result of the proximate composition is shown in Table 1. The analyzed crude protein (CP) value is higher than the calculated value as shown in Table 2.The higher CP in the diet might be attributed to the high level of protein in sesame seed meal as shown in Table 1. Asogwa *et al*. (2005) reported that sesame seed meal contains about 25% CP. The value of the ether extract (EE) falls within (10 - 20%) recommended by Irlbeck, (2001). Anon.(2006) reported that Sesame plant and it seed has high oil content (close to 50%). The crude fibre values (CF) decrease with increase in the levels of sesame seed meal. The CF levels (10 - 16.5%) is within the range 15 – 20% reported by Cheeke (1985). The nitrogen free extract (NFE) is highest in T_1 and lowest in T_4. the NFE decrease with increase in the levels of sesame seed meal. The metabolisable energy (ME) levels of the diets were 2808.54, 2716.54, 2726.14 and 2846.94 Kcal/kg for diets 1 (control), 2, 3 and 4, respectively. The energy levels were comparable to the levels reported by Aduku and Olukosi ((1990) for weaner rabbits.

Table 2. Proximate composition of the experimental diets

	Treatments/Diets				
Ingredient (%)	$T_{1(0\%ssm)}$	$T_{2(4\%ssm)}$	$T_{3(8\%ssm)}$	$T_{4(12\%ssm)}$	SSM
Dry matter (DM)	96.40	95.90	95.90	95.10	98.40
Crude protein (CP)	22.40	30.90	31.50	32.00	30.10
Ether extract (EE)	11.00	11.00	13.00	19.50	39.00
Crude fibre (EE)	16.50	15,00	13.50	10.00	9.50
Ash	3.00	2.00	1.50	1.50	4.00
Nitrogen-free extract (NFE)	43.50	37.90	36.40	33.10	15.80
ME (Kcal/Kg)*	2808.54	2716.54	2726.14	2846.94	-

SSM = sesame seed meal, *metabolizable energy (Kcal/kg)

Table 3. Calculated analysis

Ingredient (%)	$T_{1(0\%ssm)}$	$T_{2(4\%ssm)}$	$T_{3(8\%ssm)}$	$T_{4(12\%ssm)}$
Dry matter (DM)	94.14	94.23	93.33	94.14
Crude protein (CP)	17.88	18.23	18.96	19.86
Ether extract (EE)	9.00	11.00	13.00	19.50
Crude fibre (CF)	8.29	9.36	12.78	14.28
Ash	3.12	3.66	4.23	5.33
Nitrogen-free extract (NFE)	55.85	51.98	44.36	35.17
ME (Kcal/Kg)*	28.19.32	2862.13	2931.32	2973.33

*Metabolizable energy (Kcal/kg)

Growth performance

The result of the performance indices is shown in Table 4. The final live weight, daily feed intake and feed conversion ratio were significantly different ($p<0.05$) as influence by replacement of groundnut cake with sesame seed meal. There were significant difference ($p<0.05$) for live weight again. The final weight (1182.33 - 1557.44 g/rabbit) obtained at the end of the experiment was similar to the range reported by Onifade and Tewe (1993) for rabbits of similar ages. Rabbits on diets 3 (8% sesame seed meal) significantly ($p<0.05$) gained more weight than those on the other treatment groups. However, the mean daily gain (12.62 - 18.58 g/day) falls within the range of 10 - 20 g/day observed in most rabbits reared in tropical environment (Cheeke, 1987).

Table 4. Growth performance of rabbits fed graded levels of sesame seed meal

	Treatment/Diets				
Parameters (%)	T_1	T_2	T_3	T_4	SEM
Initial body weight (g)	378.00	387.00	387.00	387.00	0.20^{NS}
Final body weight (g)	1182.33^{d}	1304.68^{c}	1557.44^{a}	1449.90^{b}	1.76*
Total weight gain (g)	785.33^{d}	917.68^{c}	1170.44^{a}	1062.90^{b}	0.03*
Daily feed intake (g)	12.62^{d}	14.57^{c}	18.58^{a}	16.87^{b}	0.16*
Feed conversion ration	3.70^{a}	2.25^{b}	2.93	3.02^{c}	0.003*
Mortality	0.00	0.00	0.00	0.00	-

a, b, c, d = Means within the same row with different superscripts are significantly different ($p<0.05$)

The daily weight gain showed significant difference($p<0.05$) among treatments. The daily weight gain is similar to the values (15 - 20 g/day) reported by Schiere (1999) and 11.37 - 19.11 g/day reported by Njidda and Igwebuike (2006) for growing rabbits. The performance by rabbits in this study was significantly higher ($p<0.05$) than the 10 g/day and 7.8 g/day reported by Abu and Ekpenyong, (1993). The higher daily live weight gain observed in T_3 (18.58 g/day) may be attributed to the high feed intake observed in T_3. The feed conversion ratio (FCR) ranges from 2.93 - 3.70. The best FCR was observed in T_3 (2.93). The FCR were lower than 6.91 - 7.30 reported by Abu and Ekpenyong (1991). The differences observed in the FCR may be attributed to the composition of the diet. Relatively all the rabbits receiving sesame seed meal in their diets recorded better FCR than the control (0% sesame seed meal).

Apparent nutrient digestibility

The result of the nutrient digestibility is shown in Table 5. There were significant differences ($p<0.05$) among treatments for dry matter digestibility (DMD), crude protein digestibility (CPD), Crude Fibre digestibility (CFD) and ether extract digestibility (EED). The DMD of T_1 is significantly inferior to groups on sesame seed meal-based diets. The effects of fat digestibility of the diets are equivocal. Asogwa *et al*. (2005) reported that the addition of vegetable oil to a ration did not have any effect on digestion of dry matter, ether extract or crude protein. On the contrary by Lebas (1975) on addition of oil. The CFD range between (52.33 - 59.72%). The treatment groups on the sesame seed meal diet performed better than the control group. The CFD was slightly lower than the other nutrient digestibility except for ash. Variations exist in the coefficient for the most commonly used feed stuffs. Variation in fibre digestibility is especially wide, making interpretation difficult (Pairet *et al*., 1986). In germ free rabbits, which do not practice corprohagy digestibility coefficient of fat and protein are increase and carbohydrate and fibre are decreased (De-Blas and Gidenne, 1998). This could be possible explanation observed in the decrease of the CFD. The crude protein digestibility (CPD) were significantly higher ($p<0.05$) in all the treatment groups with the highest in T_3 (85.21%) and lowest in T_1 76.42%). The digestibility of CP was reported to increase as the dietary CP level rises, but becomes markedly depressed by an increase in crude fibre content of a diet (Lang, 1981). The result of the ether extract digestibility (EED) shows that the EED increased with increase in the level of sesame seed meal. The EED ranges from 62.46 to 81.23 with the highest in T_4 (12% sesame seed meal inclusion). Sirato-Yasumoto (2001) suggested that the presence of saponified fat which is not detected by ether extraction may have resulted in spuriously high apparent digestibilities of fat been quoted in many experiments. The ash digestibility is shown to increase with increase in the levels of sesame seed meal.

Table 5. Effect of sesame seed (*Sesamun indicum*) meal on apparent nutrient digestibility of rabbit

	Treatment				
Nutrient (%)	T_1	T_2	T_3	T_4	SEM
Dry matter (DM)	60.13^{c}	63.42^{b}	81.68^{a}	66.17^{b}	1.21*
Crude protein (CP)	76.42^{d}	80.13b	85.21^{a}	78.32^{c}	0.03*
Ether extract (EE)	62.86^{b}	71.72^{b}	78.63^{a}	81.23^{a}	1.14*
Crude fibre (CF)	52.33^{c}	56.72^{b}	59.32^{a}	55.23^{b}	0.31*
Ash	32.00^{d}	52.50^{c}	73.33^{b}	67.57^{a}	2.41*

a, b, c, d = Means within the same row with different superscripts are significant different ($p<0.05$)

Economic performance of rabbits fed graded levels of sesame seed meal

The economic analysis of feeding rabbits on varying levels of sesame seeds is presented Table 6. The cost per kilogram feed were ₦64.30, ₦57.10 and ₦61.10 in diets 1 (control), 2, 3, and 4 respectively; the correspond cost per kilograms gain were ₦237.95, ₦188.08, ₦167.50 and ₦184.51 respectively. The percentage reduction in cost per kilogram gain were 0, 20, 96, 29.61 for T_1 (control), T_2, T_3 and T_4 respectively. The cost/kg gain were higher in T_1 and lowest in T_3. The reduction in cost/Kg gain was better in T_3 (29.61%) than the other treatment groups receiving sesame seed meal. On economic ground therefore, diet 3 (8% sesame seed inclusion) was the best. Therefore diets containing up to 8% sesame seed meal could be fed to growing rabbits without compromising the growth and economic performance.

Table 6. Economic performance of rabbits fed graded levels of sesame seed meal

	Treatment				
Parameters (%)	T_1	T_2	T_3	T_4	SEM
Number of rabbits	3	3	3	3	-
Feed cost/kg (₦/Kg)	64.30	57.90`	57.10	61.10	-
Total feed intake (kg)	2.942^{c}	2.982^{c}	3.432^{a}	3.210^{b}	0.03
Total feed cost (₦)	189.17	172.66	195.97	196.13	-
Total weight gain (kg)	0.795^{d}	0.918^{c}	1.170^{a}	1.063^{b}	0.02
Fed cost/kg gain	237.95	188.08	167.50	184.51	-
Reduction in cost/kg Gain (%)	-	20.96	29.61	22.46	-

a, b, c, d = means within the same row with different superscripts are significant different ($p<0.05$); SEM = standard error of means

CONCLUSION

The study reveals that the replacement of groundnut cake with sesame seed meal in the diets of growing rabbits has no negative effect on growth performance, nutrient digestibility and economic perform mace of the rabbits.

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