

Growth Performance of Growing Rabbits Fed Graded Levels of Commercial and Locally Produced Groundnut Cakes

¹Habiba Lami Mohammed, ¹Sa'aci Alhaji Zhitsu, ¹Mohammed Ibrahim, ¹Rebecca Ramatu Kolo, ¹Kubra Alhaji Shehu, ²Ruth Jummai Ndagimba

¹Department of Agricultural Technology, Federal Polytechnic Bida, Niger State, Nigeria

²Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, Nigeria.

*Corresponding Author: habibalamimohammed@gmail.com

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ABSTRACT

Evaluate the growth performance of weaned rabbits fed diets containing varying levels of locally produced and commercial grade groundnut cake. Determine the nutrient digestibility of weaner rabbits fed diets containing varying levels of locally produced and commercial grade groundnut cake. Assess the carcass characteristics of weaner rabbits fed diets containing varying levels of locally produced and commercial grade groundnut cake. The results showed that final body, total body weight gain and daily weight gain and feed conversion ratio of the rabbits were significantly ($P < 0.05$) influenced by the dietary treatments. However, total feed consumed and daily feed consumed of the rabbits were not significantly ($P > 0.05$) different. Crude protein, crude fibre, ether extract and nitrogen free extract digestibility were significantly ($P < 0.05$) affected by the dietary treatments. However, dry matter and ash digestibility are not influenced ($P < 0.05$). Lungs result showed that G3 (5 % CGNC), G4 (10 % LGNC), G6 (20 % LGNC) and G7 (20 % CGNC) had no variation and similar trend was also observed on G2 (5 % LGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G7 (20 % CGNC) respectively. G1 (Control) had least values throughout the treatment groups. The kidney result showed that G3, G5 and G7 were not significantly ($P < 0.05$) different when compared. Likewise, G1 (Control), G2 (5 % LGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G6 (10 % LGNC) were not varied. The result of intestine showed that G3 (5 % CGNC), G5 (10 % CGNC) and G7 (20 % CGNC) had the same intestine value than other groups. Likewise, similar trend was observed on G1 (Control), G2 (5 % LGNC) and G4 (20 % LGNC). On the other hand, lowest

intestine value was recorded on G6 (20 % LGNC). Abdominal fat outcome indicated G1 (Control), G3 (5 % CGNC), G5 (10 % CGNC) and G6 (20 % LGNC) had more abdominal fat than other treatments. However, least abdominal fat was observed on G2 (5 % LGNC) and G4 (5 % LGNC). Though, G4 (10 % LGNC) and G7 (20 % CGNC) were similar across the groups. It can be concluded that rabbits fed CGNC at 5 %, 10 % and 20 % had significant performance on and daily weight gain compare to those fed LGNC. The dry matter digestibility shows that there was no significant difference among the dietary groups.

Keywords : Weaned Rabbit, Growth Performance, Nutrient digestibility, Carcass Characteristic

I. INTRODUCTION

The existing inflation across the world has led to inadequate food supply to sustain the ever increasing human population (Biobaku *et al.*, 2003). The demand for protein has risen greatly and the human dependence on animal for protein is also increasing, since plant proteins are generally deficient in four indispensable amino acids like lysine, methionine, leucine and tryptophan. If meat consumption is to be satisfied in Nigeria, the production of short-cycle animals like poultry and rabbits should be encouraged and due consideration should also be given by appropriate research institutes and government to their categories of animal (Lebas, 2013).

The inadequacy of animal protein coupled with stiff competition between man and animals for agricultural produce call for enhancing the diversification and productivity of livestock; and this has culminated in resurgence of interest in rabbit production (Oyadeyi *et al.*, 2011). The renewed interest in rabbit production by researchers and farmers in Nigeria has necessitated research into alternative feed resources that are readily available, under-utilized agro by-products or agro-industrial-wastes to substitute or supplement the highly demanded conventional cereals. Major aspect of

livestock production that constitutes huge cost and demands urgent attention is the utilization of quality animal feeds. One of the suitable plant protein products that can be utilized in rabbit nutrition is ground nut cake (GNC) which contains reasonable amount of essential amino acids (Atteh and Opawande, (2000).

Groundnut (*Arachis hypogaea* L.) cake/meal is an important source of dietary protein for domestic animals, and has a cost advantage over the other conventional animal protein sources used in feed production. It has been considered among others as a good substitute for fish meal (Ekanem, 2003). Groundnut cake is an abundant, cheap and easily available plant protein source that is high in crude protein content (40-45%). Feed ingredients used for rabbit rearing are usually selected on the basis of their nutrient content (proximate composition), cost, availability and acceptability by rabbits, as food (Eyo and Ezechie, 2003).

The different processing methods applied on the GNC meals may have led to decreased dietary protein utilization. Thus, it can be attributed to the protein being denatured, leached and vaporized, which may

result in reduced performances, although roasted GNC meal produced better results.

Statement of the Problem

The greatest constraints limiting animal production in lesser developed countries were identified as poor feed stuff and high cost of feed. Few studies have been conducted on the nutritive potential of the locally produced ground nut cake as feed ingredient in rabbit nutrition.

Justification for the Study

There is competition between man and his livestock for commercial groundnut cake as protein feed stuff. In this respect, there is need to exploit locally available and relatively cheaper alternatives to meet the nutritional requirements of rabbits. Local groundnut cake contains 40-45 % crude protein. Hence, it could be a valuable source of protein in the diet of rabbits by reducing cost of feeding (Atteh and Opawande, 2000).

Aim and Objectives of the Study

The aim of this study was to evaluate the effect of feeding diets containing graded levels of locally produced and commercial groundnut (*Arachis hypogaea*) cake on the growth performance, carcass yield and nutrient digestibility of weaner rabbits.

II. MATERIALS AND METHODS

Experimental Location

The experiment was carried out at the Rabbitry Unit of Teaching and Research Farm of the Department of Animal Production, School of Agriculture and Agricultural Technology, Federal University of Technology Minna, Niger State, Nigeria. The town is situated between latitude 9° 28 and 9° 37 North, longitude 6° 23 and 6° 33 East. It has an annual rainfall of 1000 – 1500 mm and average temperature of 32 °C. It is located in the Southern Guinea Savannah Vegetation Zone of Nigeria (Minna meteorological station, 2022).

Preparation of local groundnut cake (kuli-kuli)

The dry shelled groundnut was purchased from Mokwa local market, it was sorted to select wholesome nuts, salted, toasted at 95 °C with pot and sharp sand on gas. The nuts pleura (mesoderm) were removed. Pepper and ginger were added and milled into smooth paste using Hammer mill. Groundnut smooth paste was transferred into a mixing bowls, salt and powdered dry pepper was added as seasoning. It was thoroughly mixed in the bowl and transferred to a clean chopping board. Vigorous kneading was applied to enable the oil to be extracted out of it. The mixture gradually harder and became sticky during the kneading process and oil was continually extracted. After which they were molded into ball shapes and fried using the oil extracted during the kneading process until a fairly brown colour was obtained. The produced “kuli-kuli” was allowed to cool in a room temperature (29 °C for about 15 – 20min and then transferred to an air-tight container to keep the “kuli-kuli” crunchy and safe from microbes.

As prepared local groundnut cake were further pulverized with hammer milled and mixed with other feed ingredients at different levels for experimental diets.

Source of Experimental Animals and Feed Ingredients

A total of 63 crosses of New Zealand white with California weaned rabbits of mixed sexes of 4 -5 weeks old with an average weight of 500 g.was sourced from Sultan Veterinary Consult, Samaru Zaria, Kaduna State. Kuli-kuli was purchased from the Mokwa modern market, while commercial groundnut cake was bought from Sabon feed mill behind U.K. Bello Art theatre, Minna, Niger state. The locally produced and commercial groundnut cakes are obtained as by-products from processing industries of common Groundnut seeds after the oil extraction respectively. The proximate composition of the locally produced and commercial grade groundnut cake is presented in Table 3.1.

Experimental Diets

The experimental diets were formulated in line with the recommendations of NRC (1994) for weaner rabbits using the following ingredients: maize, kuli-kuli (LCGNC) and commercial groundnut cake

(CGNC), soybean cake, wheat offal, fish meal, bone meal, salt, limestone, and vitamins/minerals premix. The percentage composition of the experimental diets is shown on Table 3.2.

Table 1. Proximate Composition of Commercial and Locally Produced Groundnut Cakes

Parameter (%)	Commercial Grade Groundnut Cake	Locally Produced Groundnut Cake
Dry matter	91.89	88.94
Crude protein	48.09	52.86
Crude fibre	6.02	3.68
Ether extract	8.91	11.01
Ash	6.74	4.21
Nitrogen free extract	30.21	28.24
ME/kcal/kg	3573.49	3850.15

Table 2: Percentage Composition of the Experimental Diets

Ingredients (%)	G1 (00 % GNC)	G2 (5 % LGNC)	G3 (5 % CGNC)	G4 (10 % LGNC)	G5 (10 % CGNC)	G6 (20 % LGNC)	G7 (20 % CGNC)
Maize	58.00	58.00	58.00	58.00	58.00	58.00	58.00
Soybean Meal	24.00	19.00	19.00	14.00	14.00	4.00	4.00
Commercial Groundnut Cake	0.00	0.00	5.00	0.00	10.00	00.00	20.00
Kuli-kuli	0.00	5.00	0.00	10.00	0.00	20.00	00.00
Wheat Offal	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis							
Crude Protein	18.45	18.44	18.40	18.03	18.01	18.02	18.01
Crude Fibre	12.05	12.19	12.19	12.72	12.72	13.02	13.02
Ether Extract	3.41	3.53	3.67	3.78	4.01	4.18	4.17
Calcium	0.99	1.12	1.20	1.28	1.34	1.41	1.43
Phosphorus	0.81	0.88	0.98	1.04	1.08	1.15	1.19
ME (kcal/kg)	2746.46	2785.51	2787.91	2789.61	2784.21	2786.15	2798.03

The premix supplied the following nutrients kg⁻¹: Vitamin A, 500 IU; Vitamin D₂ 1500 IU; Vitamin E 3, IU; Vitamin K 2, mg; Riboflavin, 3 mg; panthenic, acid 6 mg; Niacin, 15 mg; Vitamin B₁₂, 0.8 mg; Chlorine, 3 mg; Folic acid, 4mg; Manganese, 8 mg; Zinc, 0.5 mg; Iodine, 0.1 mg; Cobalt, 1.2 mg.

ME = Metabolizable energy,

CGNC = commercial groundnut cake,

LGNC=.Local groundnut cake

Experimental Design

A total of 63 crosses of New Zealand white and California weaned rabbits of mixed sexes of 4 -5 weeks old with an average weight of 500 g. they were randomly divided into seven treatments and further sub-divided into three replicates with three rabbits per replicates in a Completely Randomized Design (CRD) Experiment.

Management of the Experimental Animals

A constructed wooden cage of height 60 cm, length 45cm and width 40 cm with floor space of between 0.39 by 0.55 cm and 50 cm length with net fitting was used for the experiment. Prior to the beginning of the experiment, the cages were thoroughly washed with disinfectants. Clean feeders and drinkers were placed in each cage for easy access by the animals. The vitalityte was administered to the rabbits via drinking water to reduce stress. They were de-wormed using Albendazole and broad spectrum antibiotic was also administered for prophylactic treatment. The rabbits were acclimatized to the new environment and fed basal diets for one week. Thereafter, the experimental diets and water was served *ad-libitum* to the rabbits separately for 12 weeks.

Data Collection

Data were collected on the growth performance, nutrient digestibility and carcass characteristics of the experimental animals.

Growth performance

Feed intake: On a daily basis, the experimental diets supplied to the rabbits were weighed for each replicate.

Likewise, the left over feed weighed. Feed intake was determined as follows:

$$\text{Feed intake} = \frac{\text{feed offered} - \text{feed left over}}{\text{total number of rabbits}}$$

Weight gain. The rabbits were weighed with a Camry top-loader weighing scale at the commencement of the experiment and at weekly intervals, The weight gain of each rabbit was determined using the following formula:

$$\text{body weight gain (g)} = \frac{\text{current week body weight gain} - \text{previous week body weight gain}}{\text{total number of rabbits}}$$

Feed conversion ratio (FCR). This is defined as the quantity of feed intake that will produce a kilogram of weight gain, it was determined as follows:

$$\text{FCR} = \frac{\text{feed intake}}{\text{weight gain}}$$

Nutrient Digestibility Trial

A nutrient digestibility trial was carried out at the 12th week of the experiment. Two (2) rabbits of average weight 1750.34 g were randomly selected from each replicate and transferred to constructed metabolic cages. Feed was served for seven (7) days, the total faeces voided, was collected separately from each replicate for five days using the total collection method, Collected faeces were weighed preserved with boric acid in aluminum foil paper before oven dried at 80 °c for 24 hours. At the end of the experiment, the dry matter, crude protein, crude fibre, ether extract nitrogen free extract and ash content of the faeces was determined using the procedure of AOAC (2000). The following formula was used to determined apparent nutrient digestibility:

$$\text{Nutrient digestibility} = \frac{\text{Nutrient in feed intake} - \text{Nutrient voided in faeces} \times 100}{\text{Nutrient in feed intake}}$$

Rabbit Carcass yield Evaluation

At the end of the growth performance study, one (1) rabbit from each replicate was randomly selected for carcass evaluation. The selected rabbits were starved of feed for 12 hours but given access to water. They were weighed using a weighing scale, slaughtered by cutting the jugular vein with a sharp knife at the neck region and washed with clean water. The slaughtered rabbits were processed by scalding. Hot carcasses were suspended in a ventilated area for 30 minutes for proper draining of blood before being eviscerated; head, liver, lungs, thymus, trachea, esophagus, heart and kidneys were removed to obtain the dressed carcass, containing only meat, fat and bone. The carcasses were weighed. Thereafter the formula of Aduku and Olukosi (1990) will be used to obtain the dressing percentage thus:

$$\% \text{ Dressing} = \frac{\text{Dressed carcass weight}}{\text{Live weight}} \times 100$$

Chemical Analysis

Proximate composition of the experimental diets and voided faeces was carried out using the procedures of AOAC (2000).

Cost benefit analysis

All feed ingredients used in compounding the experimental diets for weaner rabbits were monetized. Therefore, the cost effect of feeding diets containing graded levels of locally produced and commercial groundnut cakes was determined using the following formula described by (Egbewande, 2018).

- I. Cost of feed/kg: this was determined by dividing cost of feed/bag by the quantity of feed in kilogram per bag.
- II. Total cost of feed consumed/kg: this was done by multiply kilogram of total fee consumed by cost of feed per kg.
- III. Feed cost/weight gain/kg: it was calculated by dividing feed/kg by weight gain/kg.
- IV. Savings on feed cost (%) were calculated as the differences in the cost of feed consumed in each

group divided by the cost of feed consumed in the control group multiply by hundred.

Statistical Analysis

Data collected were subjected to two way analysis of Variance (ANOVA) using General linear model of Statistical Analysis System (SAS, 2015). Duncan's Multiple Range Test was used to separate differences between means.

III. RESULTS

Growth Performance of Growing Rabbits Fed Graded Levels of Commercial and Locally Produced Groundnut Cakes

The results of growth performance of weaner rabbits fed diets containing graded levels of locally produced and commercial groundnut cake is presented in Table 3. The results showed that final body, total body weight gain and daily weight gain and feed conversion ratio of the rabbits were significantly ($P < 0.05$) influenced by the dietary treatments. However, total feed consumed and daily feed consumed of the rabbits were not significantly ($P > 0.05$) different.

The final weight gain result indicated that G7 (20 % CGNC) had significantly higher weight gain than those on the other treatments but not significantly ($P < 0.05$) different from G3 (5 % CGNC) and G5 (10 % CGNC). The findings of total body weight gain and daily body weight gain revealed that rabbits on G3 (5 % CGNC), G5 (10 % CGNC) and G7 (20 % CGNC) were not significantly varied ($P > 0.05$) across the treatment groups, but had greater weight gain when compared with those on the other treatment groups. However, least weight gain was observed on G1 (control), G2 (5 % LGNC) and G6 (20 % LGNC) respectively.

The outcome of the feed conversion ratio showed that G5 had better FCR than the rest treatment groups and not significant ($P > 0.05$) from G2 (5 % LGNC), G3 (5 % CGNC), G4 (10 % LGNC) and G7. However, low feed conversion ratio was found on G6 (20 % LGNC) but had similar values with G1 (Control), G2 (5 % LGNC),

G4 (10 % LGNC) and G6 (20 % LGNC) across the treatment groups.

Table 4. Shows the effect of dietary levels of different groundnut cakes on growth performance of growing rabbits. The results revealed there were dietary ($P < 0.05$) effects in all growth parameters measured except initial body weight, total feed consumed, daily feed consumed, weekly feed intake and feed conversion ratio across the treatment. The findings showed that rabbits on 5, 10 and 20 % LGNC and CGNC inclusion levels had higher final body weight, body weight gain,

daily weight gain and weekly body weight gain than those in the control group.

The findings of groundnut cake (GNC) source indicated there were significant ($P < 0.05$) influence in the entire growth traits measured except initial body weight and feed intake. The results showed that those fed commercial groundnut cakes performed better than those on locally produced groundnut cakes and control. However, there were not Significant ($P > 0.05$) different between those fed LGNC and control group.

Table 3 : Effect of Feeding Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cake on Growth Performance of Growing Rabbits

Parameters (g/R)	G1 (0 % LCGNC)	G2 (5 % LGNC)	G3 (5 % CGNC)	G4 (10 % LGNC)	G5 (10 % CGNC)	G6 (20 % LGNC)	G7 (20 % CGNC)	SEM	P-value
Initial live weight	595.63	594.06	594.92	594.32	594.80	600.84	601.55	1.35	0.63
Final weight	1727.82 ^b	1725.56 ^b	1806.32 ^a	1723.59 ^b	1794.56 ^a	1696.73 ^b	1816.51 ^a	10.71	0.00
Total feed intake	6803.39	6663.98	6828.32	6719.53	6528.69	6797.46	6808.40	39.71	0.41
Body weight gain	1131.97 ^b	1131.26 ^b	1211.38 ^a	1129.28 ^b	1199.75 ^a	1095.93 ^b	1214.98 ^a	10.78	0.00
Daily feed intake	80.98	79.32	81.28	79.98	77.71	80.91	80.93	0.47	0.42
Daily body weight gain	13.47 ^b	13.46 ^b	14.41 ^a	13.43 ^b	14.27 ^a	13.04 ^b	14.45 ^a	0.12	0.00
FCR	6.02 ^b	5.88 ^{ab}	5.63 ^a	5.94 ^{ab}	5.44 ^a	6.19 ^b	5.59 ^a	0.05	0.00

abc= Means in the same row with different superscript are significantly ($P < 0.05$) different.

SEM= Standard error of mean, G = treatment group, P – Value = Probability values,

LGNC = Local groundnut cakes, CGNC = Commercial groundnut cake

Effect of Feeding Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cake on Apparent Nutrients Digestibility of Weaner Rabbits

The results of the nutrient digestibility of weaner rabbits fed graded levels of locally and commercially produced groundnut cake is presented in Table. 4. The results showed that crude protein, crude fibre, ether extract and nitrogen free extract digestibility were

significantly ($P < 0.05$) affected by the dietary treatments. However, dry matter and ash digestibility are not influenced ($P < 0.05$).

Crude protein digestibility result indicated that G2 (5 % LGNC), G3 (5 % CGNC), G4 (10 % LGNC), G6 (20 % LGNC), and G7 (20 % CGNC) had similar nutrient digestibility values while the same trend was observed on G2, G4, and G7 across the treatments group. However, G1 (Control) had least crude protein digestibility across the dietary treatments. Significantly higher CP digestibility was recorded on G3 (5 % CGNC), G5 (10 % CGNC) and G6 (20 % LGNC) respectively over other groups.

The result of crude fibre digestibility showed that G3 (5 % CGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G6 had identical values as compared with other treatments group. Likewise those rabbits on G1 (control), G4 (10 % LGNC), G6 (20 % LGNC) and G7 (20 % CGNC) also had the same digestibility values while G1 (control) and G2 (5 % LGNC) were not significantly varied ($P>0.05$). On the other hand, G3 (5 % CGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G7 (20 % CGNC) had higher fibre digestibility across the treatments than other treatments groups.

The ether extract digestibility of rabbits revealed that those on G1 (control), G2 (5 % LGNC), G3 (5 % CGNC), G4 (10 % LGNC) and G5 (10 % CGNC) had similar ether extract digestibility statistically as compared with other treatment. The digestibility of ether extract of rabbits on G2 (5 % LGNC), G4 (10 % LGNC), G5 (10 % CGNC), G6 (20 % LGNC) and G7 (20 % CGNC) were also similar. Nitrogen free extract digestibility of rabbits on G3 (5 % CGNC), G5 (10 % CGNC), G6 (20 % LGNC) and G7 (20 % CGNC) had the same digestibility values when compared with the rest of the treatment group. Likewise, rabbits on G1 (control) and G2 (5 % LGNC) also had similar nitrogen free extract digestibility. However, best NFE digestibility was observed on G7 (20 % CGNC), this improvement might

be due to essential biological value of commercial groundnut cake in rabbits diets.

Effect of Feeding Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cake on Carcass Yield of Weaner Rabbits

The results of the carcass yield of weaner rabbits fed graded level of commercial and local groundnut cake is presented in Table 4.3. The result showed that live weight, carcass weight dressed percentage, cervical, back loin, fore limbs, hind limbs, lumber were significantly influenced by the dietary treatments, except in sacrum.

The result of live weight revealed that G3 (5 % CGNC), G4 (10 % LGNC), G5 (50 % CGNC), G6 (20 % LGNC) and G7 (20 % CGNC) had significantly, similar value as compared to other treatments groups while G1, G2, and G6 are statistically not different ($P>0.05$). The result of carcass weight and dressed % indicated that G3 (5 % CGNC), G5 (10 % CGNC) and G7 (20 % CGNC) recorded significantly higher values over other treatment group. On the other hand, G1 (control), G2 (5 % LGNC), G4 (10 % LGNC) and G6 (20 % CGNC) were not significantly different across the treatment groups and revealed significantly lower carcass weight and dressed % than the rest of the treatment groups.

Table 4: Effect of Feeding Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cake on Apparent Nutrients Digestibility of Weaner Rabbits

Parameters (%)	G1 (0%LCGNC)	G2 (5%LGNC)	G3 (5%CGNC)	G4 (10%LGNC)	G5 (10%CGNC)	G6 (20%LGNC)	G7 (20%CGNC)	SEM	P-value
Dry matter	87.98	86.64	89.21	87.15	89.02	87.20	85.67	2.32	0.06
Crude protein	74.75 ^c	76.51 ^{ab}	80.11 ^a	78.59 ^b	81.28 ^a	82.38 ^a	78.35 ^b	2.10	0.01
Crude fibre	67.50 ^{bc}	76.14 ^c	75.02 ^a	79.93 ^{ab}	80.31 ^a	74.86 ^{ab}	78.52 ^b	1.75	0.02
Ether extract	85.43 ^a	79.96 ^{ab}	81.16 ^a	79.11 ^{ab}	79.23 ^{ab}	77.56 ^b	76.25 ^b	2.39	0.01
Ash	69.73	65.49	71.33	73.76	68.68	70.19	74.38	2.96	0.13
Nitrogen free extract	78.45 ^c	80.23 ^c	87.57 ^a	84.34 ^b	88.43 ^a	87.34 ^a	89.61 ^a	2.36	0.00

abc = means in the same row with different superscript are significantly different ($P < 0.05$).

SEM= Standard error of mean.

G = treatment group, P – Value = Probability values.

CGNC = Commercial groundnut cake.

LGNC = Local groundnut Cake

The fore limbs result showed that G3 (5 % CGNC), G5 (10 % CGNC) and G7 (20 % CGNC), differs significantly from G1 (control), G4 (10 % LGNC), and G6 (20 % LGNC). Back loin result showed that G5 and G7 differ from G6 but statistically the same with other treatment groups. Hind limb values showed that G7 are significantly better G1, G2 and G6. However, fore limbs of rabbits fed diets 3, 5, and 7 showed better performance.

Table 5: Carcass Yield of Weaner Rabbits Fed Diets Containing Graded Levels of Locally Produced and Commercial Groundnut Cake

Parameters	G1	G2	G3	G4	G5	G6	G7	SEM	P-value
(g/)	(control)	(5%LGNC)	(5%CGNC)	(10%LGNC)	(10%CGNC)	(20%LGNC)	(20%CGNC)		
Live weight	1673.62 ^b	1706.76 ^b	1787.21 ^a	1658.72 ^a	1799.42 ^a	1687.05 ^{ab}	1811.67 ^a	2.98	0.01
Carcass weight	1261.58 ^b	1291.49 ^b	1375.98 ^a	1235.57 ^b	1371.26 ^a	1255.80 ^b	1389.80 ^a	1.78	0.01
Dressed (%)	75.38 ^b	75.67 ^{ab}	76.99 ^a	74.48 ^b	76.20 ^a	72.59 ^c	76.60 ^a	1.11	0.00
Back loin (%)	10.05 ^{ab}	10.03 ^{ab}	10.58 ^a	10.24 ^{ab}	9.98 ^{ab}	8.87 ^c	9.84 ^b	0.80	0.00
Fore-limbs (%)	11.80 ^{ab}	11.12 ^b	12.17 ^a	12.02 ^a	11.91 ^{ab}	11.78 ^{ab}	12.11 ^a	0.48	0.01
Hind-limbs (%)	14.14 ^{ab}	13.74 ^b	14.30 ^a	14.68 ^a	14.14 ^{ab}	13.56 ^b	14.28 ^a	0.93	0.01

G = treatment group, P – Value = Probability values, SEM= Standard error of mean.

LGNC = Local groundnut cake, CGNC = commercial groundnut Cake

Lungs result showed that G3 (5 % CGNC), G4 (10 % LGNC), G6 (20 % LGNC) and G7 (20 % CGNC) had no variation and similar trend was also observed on G2 (5 % LGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G7 (20 % CGNC) respectively. G1 (Control) had least values throughout the treatment groups. The kidney result

Internal Organs of Weaner Rabbits Fed Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cakes

Table 6. Shows the internal organs result of weaner rabbits fed graded levels of locally produced and commercial groundnut cake based diets. The results indicated that liver, lungs kidney, intestine, and abdominal fat were significantly ($P < 0.05$) influenced by the dietary treatments except heart. The result of liver revealed that G1, G6 (20 % LGNC) and G3 (5 % CGNC) had higher liver weight than G2 and G4 but not significantly ($P > 0.05$) different with G5 and G7.

showed that G3, G5 and G7 were not significantly ($P < 0.05$) different when compared. Likewise, G1 (Control), G2 (5 % LGNC), G4 (10 % LGNC), G5 (10 % CGNC) and G6 (10 % LGNC) were not varied.

The result of intestine showed that G3 (5 % CGNC), G5 (10 % CGNC) and G7 (20 % CGNC) had the same intestine value than other groups. Likewise, similar trend was observed on G1 (Control), G2 (5 % LGNC) and G4 (20 % LGNC). On the other hand, lowest intestine value was recorded on G6 (20 % LGNC).

Abdominal fat outcome indicated G1 (Control), G3 (5 % CGNC), G5 (10 % CGNC) and G6 (20 % LGNC) had

more abdominal fat than other treatments However, and G4 (5 % LGNC). Though, G4 (10 % LGNC) and 7 least abdominal fat was observed on G2 (5 % LGNC) (20 % CGNC) were similar across the groups.

Table 6. Internal Organs of Rabbits Fed Graded Levels of Commercial and Locally Produced Groundnut Cakes Based Diets

Parameters	G1 (control)	G2 (5%LGNC)	G3 (5%CGNC)	G4 (10%LGNC)	G5 (10%CGNC)	G6 (20%LGNC)	G7 (20%CGNC)	SEM	P-value
Heart (%)	0.18	0.23	0.21	0.22	0.21	0.21	0.19	0.09	0.65
Liver (%)	1.82 ^{ab}	1.43 ^b	1.47 ^b	1.53 ^b	1.61 ^b	2.04 ^a	1.62 ^b	0.10	0.01
Lungs (%)	0.35 ^{bc}	0.41 ^b	0.81 ^a	0.39 ^b	0.38 ^b	0.51 ^b	0.37 ^b	0.57	0.02
Kidney (%)	0.54 ^b	0.52 ^b	0.56 ^{ab}	0.51 ^b	0.52 ^b	0.71 ^a	0.54 ^{ab}	0.21	0.02
Intestine (%)	11.35 ^b	10.66 ^c	13.28 ^a	11.21 ^b	12.92 ^a	9.81 ^d	11.89 ^b	0.62	0.01
Abdominal Fat (%)	0.49 ^a	0.35 ^c	0.48 ^a	0.38 ^{bc}	0.43 ^a	0.53 ^a	0.39 ^b	0.10	0.00

abc = Means in the same row with different superscript are significantly (P<0.05) differences.
 G = treatment group, P – Value = Probability values, SEM= Standard error of mean.
 LGNC = local groundnut cake
 CGNC = Commercial ground nut cake.

Cost Benefits of Weaner Rabbits Fed Diets Containing Graded Levels of Commercial and Locally Produced Groundnut Cakes

Table 7. Shows results of the effect of dietary levels of different groundnut cakes on cost benefits of growing rabbits. The findings revealed that cost of total feed consumed, cost of feed per weight gain were significantly (P<0.05) affected across the treatments. The result showed that rabbits fed 10 % GNC had least values for cost of total feed consumed, cost of feed per weight gain among the treatments. there were no significant (P>0.05) variations between those fed 0, 5 and 20 % GNC for cost of feed per weight gain.

The outcome of GNC source demonstrated there were significant (P<0.05) influence in total cost of feed consumed, cost of feed per weight gain. The results showed that rabbits received CGNC had lower values for cost of total feed consumed, cost of feed per weight gain when compare with those on LGNC.

Table 7: Effect of Dietary Levels of Different Groundnut Cakes on Cost Benefits of Growing Rabbits

GNC levels (%)	Total feed consumed (kg/R)	Cost of feed (₹/kg)	Cost of total feed consumed (Table ₹/kg)	Cost of feed per weight gain (₹/kg)	Savings (₹/kg)
0	6.80	132.93	919.56 ^a	813.66 ^a	-
5	6.74	131.04	881.17 ^c	752.96 ^{ab}	- 0.25
10	6.62	131.63	871.06 ^d	749.18 ^c	- 0.16
20	6.79	131.24	891.67 ^b	774.00 ^b	0.05

SEM	0.27	0.87	0.53	6.45	0.53
P-value	0.97	0.63	0.00	0.00	0.97
GNC source					
Non-inclusion	6.80	132.93	919.56 ^a	813.66 ^a	-
LGNC	6.72	131.73	883.87 ^b	790.41 ^b	0.20
CGNC	6.71	130.90	878.73 ^c	727.01 ^c	- 0.45
SEM	0.22	0.71	0.30	5.26	0.44
P-value	0.98	0.36	0.00	0.00	0.57

ab = Means in the same column with different superscript are significantly ($P < 0.05$) differences. SEM = standard error of mean, LGNC = locally produced groundnut cake, CGNC = commercial groundnut cake

IV. DISCUSSION AND CONCLUSIONS

DISCUSSION

Proximate Composition of the Locally Produced and Commercial Groundnut Cakes

The results showed that crude protein content, crude fibre content, ether extract content, nitrogen free extract and total digestible nutrients were significantly ($P < 0.05$) different except dry matter and ash content in Table 1. The findings of this study confirmed the report of Gernah *et al.* (2005) who recorded similar on the proximate composition of groundnut cake. However, this result disagreed with the report of Bello *et al.* (2008) whose findings on the proximate composition values (DM 92.52%, CP 48.13%, EE 6.05%, CF 5.52%, Ash 5.22% and NFE 26.53%) of groundnut were significantly different from the values obtained.

Although, the differences observed could be due to the soil in which they were grown, the differences in fertility of the soil, their geographical locations and variation in the method of processing (Biobaku *et al.*, 2003).

Growth Performance of Growing Rabbits Fed Graded Levels of Commercial and Locally Produced Groundnut Cake Based Diets.

The result revealed significant difference in all the parameter measured except feed consumed in Table 3. This result corroborated with the finding of Mujitaba *et al.* (2022) who reported that industrial groundnut cake shows good prospect as alternative cheap feeding regime for rabbit production. The author concluded that industrial groundnut cake can be included up to 75% levels in rabbit diets. However, the result obtained differed from the reports of Falcao-e-Cunha *et al.* (2007) and Yakubu *et al.* (2017) who reported non-significant differences on growth performance of weaner rabbit fed enzymes supplemented diets. This result also contradict the findings of Iyeghe-Erakpotobor *et al.* (2013) who reported that growth performance indices of weaner rabbits fed groundnut cake based diets with or without palm oil were not significantly improved.. The differences could be attributed to the type of diet, age of the animal and probably the variation in the location of studies.

Furthermore, result of feed conversion ratio indicated significant difference across the treatment groups. Rabbits fed graded levels of commercial groundnut cake recorded best FCR when compared to those animals fed locally produced groundnut cake. The FCR

values was between 5.58 - 6.19 for recorded in this experiment are similar to the values 5.43 - 6.27 obtained by Mujitaba *et al.* (2022) who fed graded levels of industrial groundnut cake to the growing rabbits. On the other hand, this FCR result disagree with the report of Mohammed *et al.* (2018) who reported feed conversion ratio of between 3.28 – 4.00 from rabbits fed different Plant Protein Sources on the Growth and Economic indices of weaner Rabbits. The reason for the variability of present results with other reports might be due to differences in the inclusion levels and strain of rabbits used in their research.

Apparent Nutrient Digestibility of Growing Rabbit Fed Graded Levels of Commercial and Locally Produced Groundnut Cake Based Diets

There were significant ($P < 0.05$) variation in crude protein, crude fibre, ether extract, total digestible nutrient and nitrogen free extract digestibility among the rabbits fed various levels of local and commercial groundnut based diets. This result agreed with the findings of Jiya *et al.* (2010) who conducted nutrient digestibility trial on rabbit fed tallow seed meal as a replacement for palm kernel cake. However, the current results are not in line with the reports of Mujitaba *et al.* (2022) who reported no significant differences in crude protein, crude fibre, ether extract, total digestible nutrient and nitrogen free extract digestibility in growing rabbits fed varying levels of industrial groundnut cake based diets. This is an indication that rabbits fed different plant protein sources utilized the available nutrient in the diets.

Carcass Characteristics of Growing Rabbit Fed Graded Levels of Commercial and Locally Produced Groundnut Cakes Based Diets

The result of carcass characteristics of growing rabbits fed graded levels of commercial and locally produced groundnut cake showed significant differences ($P < 0.05$) in all the cut-up parts except sacral region weight which was insignificants across the treatments groups. These results concord with the report of Iyeghe-Erakpotobor *et al.* (2007) who observed that high carcass yield and organoleptic properties of

growing rabbits were observed on dietary inclusion of Bambara nut meal. The result of the study is in line with the score of Steerley *et al.* (1991) reported an increase in carcass characteristics and dressing percent in weaner rabbits fed soybean meal based diets. However, these findings disagreed with the report of Onakpa *et al.* (2011) observed no significant difference in all the carcass cuts and viscera organs of rabbits fed *Parkia* fruit pulp diets. Similarly, this result also contradict the findings of Oloruntola (2018) who reported no significant variation in carcass traits when they fed enzyme supplemented diets to weaner rabbits. Feeding graded levels of commercial and locally produced groundnut cake to growing enhanced dressing percentage. This improvement might be attributed to biological efficiency of test ingredient in growth performance of the weaner rabbits.. The present result confirmed the reported Olorunsanya *et al.* (2001) who clarified that feeding growing rabbits with plant protein sources significantly increased dressing %.

Internal Organs of Growing Rabbit Fed Graded Levels of Commercial and Locally Produced Groundnut Cakes Based Diets

The internal organs results showed that kidney, liver, lung, intestine, fur and abdominal fat were significant difference across the treatment groups. However, heart, tail and testicles were not significantly varied. These results is in agreement with the report of Abubakar *et al.* (2011) who observed that optimum organoleptic properties of growing rabbits were recorded at 45% dietary inclusion of *Moringa Oleifera* leaf meal (MOLN). Similarly, the results also confirmed the findings of Wafar *et al.* (2019) who observed significant difference in the internal organs of grower rabbits fed varying levels of bovine digesta supplemented with enzyme based diets. On the other hand, this result disagreed with the reported of Uchewa *et al.* (2014) who noted insignificants difference in growing rabbits fed different levels of yam peel as replacement for maize. The variation in

the digestive organs might be connected to the detoxification of metabolites that may be present in the diets Etchu *et al.* (2014).

V. CONCLUSION

1. It can be concluded that rabbits fed CGNC at 5 %, 10 % and 20 % had significant performance on and daily weight gain compare to those fed LGNC.
2. The dry matter digestibility shows that there was no significant difference among the dietary groups.
3. It can be concluded that rabbits fed commercial groundnut cake at all dietary levels had no significant performance over those fed LGNC in live weight, carcass weight and dressed percentages.

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