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LINEAR GROWTH AND CARCASS CHARACTERISTICS OF RABBITS FED WITH SABARA LEAF MEAL (*Guiera senegalensis*) IN THE SUDAN SAVANNAH REGION OF NIGERIA

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Abstract

This study was undertaken to investigate the effect of Sabara leaf meal on the body weight and linear body measurements of rabbits. Live body and measurements of body weight, height at withers, body length, heart girth, were monitored on rabbits. Animals were managed in a completely randomized design with 4 treatments and replicates. The Sabara leaf meal (SLM) was fed at concentration of 0, 10, 20 and 30% in treatments 1, 2, 3 and 4 respectively. The experimental diets and clean drinking water were offered to the animals ad libitum. Sabara leaf meal was analysed to contain a crude protein value of 17.17%. Rabbits fed diets with 10 – 30% SLM gained weight (P<0.05) better than those fed the control diets. Initial body weights were all similar. There were significant increases in daily weight gain (P<0.05), body weight gain (P<0.05) and final body weight (P<0.01) by rabbits as the SLM level increased in the diet. SLM inclusion in the diets increases height at withers, heart girth and nose to tail with T_4 (14.20, 23.93, and 13.26cm respectively) being superior to the control. The weight of the head, fat, kidney, heart, lungs, pancreas, stomach, colon and felt of rabbits fed SLM diet were significantly (P<0.05, P<0.01) affected by the dietary treatment. The result of this study indicated that the addition of 30% SLM to the diets of growing rabbits improved growth performance. SLM could be used as a feed ingredient to raise rabbits without any visible deleterious effect on growth performance.

Keywords: *Growing Rabbits, Carcass, Sabara, Body Measurements.*

Introduction

Rabbit production in recent times has received a renewed attention as an alternative to poultry production due to the high cost of feed often associated with commercial poultry production and the incidence of bird flu, which makes poultry production unrealistic in some regions of the developing world (Raharjo, 2008). Rabbit rearing for the rural and urban poor is a veritable means of producing high quality meat at a reasonable price to reduce the risk of protein malnutrition and other ailments associated with insufficient protein intakes in humans. Fatufe *et al*., (2010) reported that rabbits like other monogastric species such as pigs and poultry, have no requirement for a specific feed ingredient, but can be fed on a wide range of nutrient sources as long as they are skilfully combined using optimised ration formulation techniques to meet the nutrient requirement for the various physiological stages of rabbit development.

Gueira senegalensis is a member of family *Combrataceae* and is locally known as Sabara in northern part of Nigeria. It is a multipurpose shrub of the Sahel and Savannah of West and Central Africa (Das, 2009; Sanon and Ledin, 2009). It has a wide range of traditional uses both in human and animals. The literature reports several recommended uses for *G. senegalensis* in traditional medicines to treats various illness including gastrointestinal disorder and rheumatism (Fiot *et al*., 2004). In animal and veterinary sciences, Kerharo and Adams (1974)

reported that it was used in diets aimed at increasing body weight, reproductive capacity and milk secretion in animals.

Linear body measurement has been used to characterised breed, evaluate breed performance and predict body weight of animals (Ibe and Ezekwe, 1994; Ozoje and Herbert, 1997). This latter report is attributed to the high genetic correlations between body weight and linear body measurements (Obike *et al*., 2010). They further reported that the use of linear body measurement to predict body weight of animals is perceived more reliably compared to the use of weighing scales which could introduce biases as a result of feed in the guts. In addition, body measurements are important data sources in terms of reflecting the breed standard (Riva *et al*., 2002) and are also important in given information about the morphological structure and development ability of the animals.

Therefore, rabbit producers are interested in the relationship that exists between bodyweight and physical characteristics, since this information would reflect in their feed efficiency and performance of the rabbits. Breeders need to establish the relationship that exists between these parameters and to organize the breeding programmes so as to achieve an optimum combination of bodyweight and good conformation for maximum economic returns (Khalil *et al*., 1987). The present paper reports experiment designed to investigate the performance, linear measurements and carcass quality of growing rabbits fed sabara leaf meal.

Materials and Methods

Location of study: The study was conducted in the Rabbitry of the Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil, Kano State, Nigeria, located in the northern Sudan Savanna ecological zone. The area lies between Latitude 11^{o} 37' N and Longitude 8^{o} 58' E, and 403 meters above sea level. The area receives an annual rainfall range of 850 to 870 mm, spread between May and October with a peak in August. The range of annual temperature and relative humidity is about 38-43^{0}C and 40-51% respectively. Three distinct seasons are recognized viz: dry cold (October – January), dry hot (February – May) and wet (June – September).

Processing of leaf meals: Fresh matured Sabara leaves were harvested in and around the Kano University of Science and Technology, Wudil. Kano State, Nigeria. The leaves were sun dried for about 9 h every day for 3 to 4 days until they became crispy while retaining its greenish coloration. The dry leaves were milled using a hammer mill to produce Sabara leaf meal (SLM).

Experimental diets: Four experimental rations were formulated such that the diet contained 0%, 10%, 20% and 30% dietary levels of SLM, designated as treatment 1 (T1), 2 (T2), 3 (T3) and 4 (T4) respectively. The chemical compositions of the formulated rations are shown in Table 1.

Chemical analysis of ingredients and diets: Proximate analysis procedure was used in determining the percent crude protein (CP), dry matter (DM), crude fibre (CF), ether extract (EE) and ash contents of both the Sabara leaf meal and the diets (Table 1). The chemical analysis was carried out according to the AOAC (2000) procedure.

Experimental animals and feeding trials: Thirty-six crossbred rabbits aged eight weeks, with initial weight ranging from 685 to 738g were randomly allocated on the weight basis to four

experimental groups of nine rabbits each and each group replicated into three in a completely randomized design (CRD) experiment. The groups were randomly assigned the diets containing the control (0%), 10%, 20% and 30% SLM respectively (Table1). Feed and water were given *ad libitum*. The rabbits were weighed at the start and at weekly intervals during the study. Feed intake was determined by subtracting feed wastage and leftover from the total feed offered. The earthen feeders had curved tips which drastically reduced feed wastage. Parameters monitored were weight change, feed intake and feed conversion efficiency (FCE). The study lasted 12 weeks.

Table 1: Gross composition of experimental diets fed to growing rabbits

Treatment (diets)				
Ingredients (%)	**T_1**	**T_2**	**T_3**	**T_4**
Maize	42.0	42.0	42.0	42.0
Sabara	0.0	10.0	20.0	30.0
Wheat offal	17.0	17.0	17.0	17.0
Groundnut cake	15.0	10.0	5.0	0.0
Rice bran	18.0	13.0	8.0	3.0
Fish meal	3.0	3.0	3.0	3.0
Bone meal	2.0	2.0	2.0	2.0
Limestone	2.45	2.45	2.45	2.45
Salt	0.30	0.30	0.30	0.30
Grower Premix[1]	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0

[1] *Premix (grow fast) manufactured by Animal care service consult (Nig) Ltd. Lagos, Supplying the following per kg of premix: Vitamin A, 5000,00 IU; Vitamin D3 800,000IU; Vitamin E, 12,000mg; Vitamin K, 1,5000mg; Vitamin B1, 1,000mg; Vitamin B2, 2,000mg, Vitamin B6, 1,500mg; Niacin, 12,000mg; pantothenic acid, 20.00mg; Biotin, 10.00mg; Vitamin B12, 300.00mg; folic acid, 150,000mg; choline, 60,000mg; manganese, 10,000mg; iron, 15,000mg, zinc 800.00mg; Copper 400.00mg; Iodine 80.00mg; cobalt 40mg; selenium 8,00mg.*

Data collection

Linear growth: Linear body measurements and body weight were taken on bi-weekly2 wk basis for 16 wk. The body weight was taken using weighing scale (Kenwood) whereas linear measurements were taken with the aid of a measuring tape in the morning before feeding the animal. Each animal was gently restrained in an unforced position while taking the measurements.

The linear traits studied were ear length (EL), length of fore limb (LFL), length of hind limb (LHL), tail length (TL), heart girth (HG), head to shoulder (HTS) and body length (BL). The description of the measurements is as follows: Ear length - measured from the tip of the ear to the junction of the ear and the skull. Length of fore and hind limb- this was measurement taken in centimetre from the shoulder and pelvic joints to the tips of the paws respectively. Head to shoulder- measured from the tip of the nose to the end of the neck bone. Heart girth- this was

determined by measuring the circumference of the chest region directly below the fore arms whereas the tail length was taken from the junction of the hip to the apex of the tail.

Carcass characteristics and organs measurement: At the end of the feeding period, feed was withheld overnight and the rabbits slaughtered for carcass evaluation. The head, the skin and all internal organs were removed. Hot carcass was weighed without any of these organs. The weights of the cut parts viz. hind and fore limbs, lumbar region, thoracic region and breast were determined, Individual organs were excised and weighed separately. The small intestine and caecum were measured while lying on a wet, coated plywood draining board, so as to avoid any artificial stretching. Individual rabbits from diets 1 to 4 were selected for the carcass characteristics.

Statistical Analysis

Data collected were subjected to analysis of variance using the General Linear Model procedure. When analysis of variance indicated significance for treatment effects, specific differences between means were detected by the Duncan Multiple range test (Duncan 1955). The following models were used.

$Y_{ij} = \mu + T_i + E_{ij}$

Where: Y_{ij} = observations; μ = overall mean; T_i = treatment ($_i$ = 1, control, $_i$ = 2, 10% SLM, $_i$ = 3, 20% SLM and $_i$ = 4, 30% SLM); E_{ij} = experimental error

Results and Discussion

The chemical composition of the experimental diet is shown in Table 2. The crude protein (CP) content of the diet was approximately 17.50%, a level adequate to meet the needs of growing rabbits. The CP value of SLM in the present study increased with as the level of Sabara leaf meal increased in the diets. The crude fibre level 16 to 18% which appreciated with increasing levels of sabara leaf meal in the diets is higher than the range of 10 to 15% reported as optimal for growth of young rabbits (De Blas *et al*., 1986).

Table 2: Chemical compositions of experimental diets and Sabara leaf meal

Treatment (diets)					
Constituent (%)	**T_1**	**T_2**	**T_3**	**T_4**	**Whole SLM**
Dry Matter (DM)	97.3	97.0	97.4	97.5	98.1
Moisture	2.5	3.0	2.6	2.5	1.9
Crude Protein (CP)	18.77	18.05	17.67	17.42	17.17
Crude Fibre (CF)	16.0	16.0	17.0	18.0	28.0
Ether Extract (EE)	2.0	2.0	2.0	2.0	3.0
Ash	4.0	4.0	3.0	3.0	3.0
Nitrogen-Free Extract (NFE)	53.94	52.85	52.23	50.99	45.50
ME (Kcal/kg)[1]	2771.36	2706.03	2669.96	2616.69	2493.54

SLM = Sabara leaf meal. [1]ME = Metabolizable energy- calculated according to the formula of Pauzenga (1985): ME = 37 X % CP + 81 X % EE + 35.5 X % NFE

This is probably due to differences in non-conventional protein fractions. The dry matter (DM) contents which varied from 97.0-97.50 were quite high. The ether extract (EE) level observed was uniform (2.00) across the four treatments groups. 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. The variations in these values could be attributed to age of the leaf and or season of harvesting. The highest moisture content was recorded for diet T_2 (10% SLM).

The effect of treatments on performance in the whole fattening period (12 weeks) is shown in Fig 1. The mean initial body weights were similar among the treatment groups, indicating that the weights of the rabbits were similar at the commencement of the experiment. The mean daily feed intake of T_1 and T_2 were significantly ($P<0.01$) higher than the other two treatment groups. The level of feed intake decrease significantly with increasing levels of SLM. The highest value was in T_1 diet (68.9g/rabbit/day), the least being in the T_4 diet (64.6g/rabbit/day). Rabbits fed SLM diets had lower feed intake without commensurate decrease in weight gain and final weight compare to those on control. The lower feed intake of rabbits on diet 3 & 4 compared to the control and diet 2 in the study did not corroborate with the findings of (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. However, Igwebuike *et al.*, (2007) attributed the low feed intake in rabbit with increase in non-conventional feed source to the adverse interaction between high ambient temperature and consumption of high fibre diets.

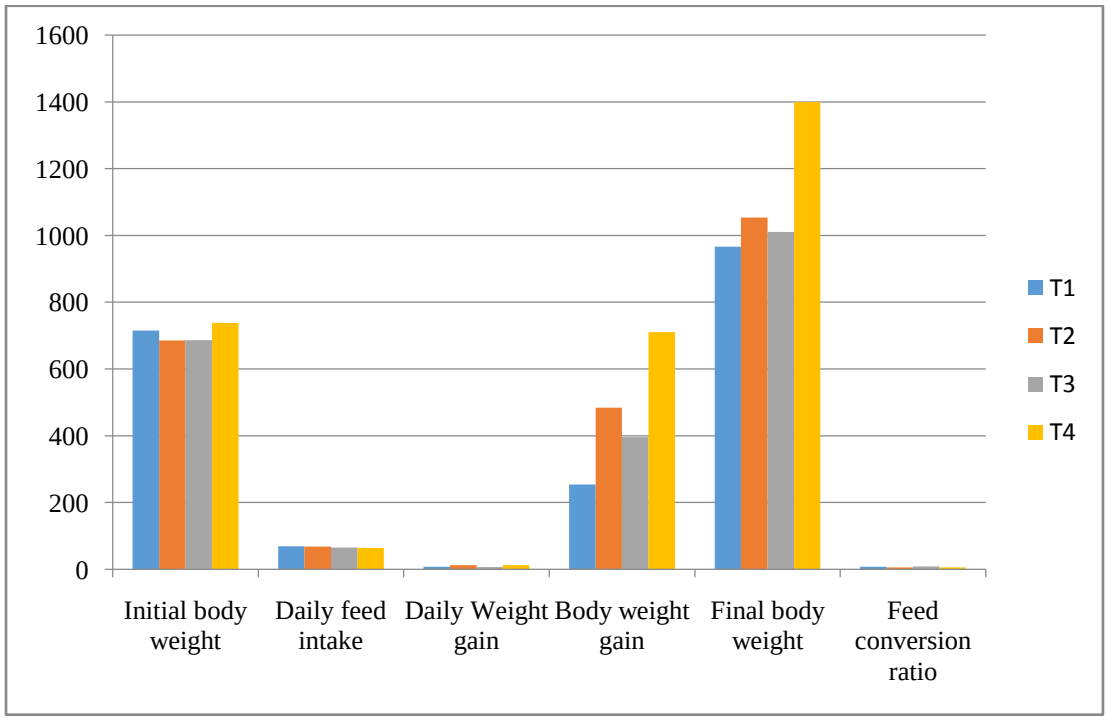

Fig.1 Performance indices of Rabbits fed Sabara leaf meal diets

Similarly, 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 T_3 and T_4. The daily weight gain was significantly higher ($P<0.05$) for rabbits fed 10% and 30% SLM in the diets (12.2g/day and 12.7g/day, respectively) as compared to those fed 0% and 20% (7.4g/day and 7.1g/day respectively). Rabbits in T_4, however did not differ ($P<0.05$) from those of T_2 and

T_1. The weight gain obtained in the study for T_2 and T_4 were within the range of (10 – 20g/rabbit/day) observed in most rabbits reared in tropical environment (Cheeke, 1987). These results indicate that not more than 30% of SLM should be included in the diet of growing rabbits.

There was a significant difference ($P<0.05$) between the mean body weight gain. Rabbits in T_4 had shown superiority in body weight gain ($P<0.05$) which increase with decreasing levels of SLM in the diet, this implies that the SLM possessed a good protein content and possibly it has growth stimulating effect, as high level of protein is essential for bogy growth. The value of final body weight of rabbits increased with increasing level of SLM. The rabbits on the T4 diet had a final body weight of 1400g which was significantly higher than the control group (966.7g). The improvement in body weight gain may be due to the protein and fibre content of the SLM which the rabbits seemed to have much appetite for. Rabbits as non-ruminant herbivores can tolerate more of fibrous feed than poultry; hence the better weight gain was obtained in this study. There was no significant difference ($P>0.05$) between the mean feed conversion ratio of rabbits. The improved feed conversion ratio of 20% level of SLM inclusion shows that the SLM is a promising feedstuff and can reduced the high cost of feed ingredients which resulted in the inadequate/poor feeding of rabbits and other livestock species. However, the need to source for other alternative feedstuffs so as to reduce the high cost of animal production cannot be overemphasized.

Table 3: Linear Growth Characteristics of Rabbit Fed Different Inclusion Level Sabara Leaf Meal

Treatment (diets)					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**Pooled SEM**
Body weight	966.70^{b}	1053.0^{b}	1010.0^{b}	1400.0^{a}	40.92^{**}
Body length	24.13	24.67	25.33	26.27	0.55^{NS}
Ear length	11.27	10.93	10.33	11.47	0.43^{NS}
Ear width	6.67	6.53	6.07	6.60	0.30^{NS}
Height at withers	13.13^{b}	13.27^{b}	13.33^{b}	14.20^{a}	0.51^{*}
Heart girth	22.27^{b}	22.15^{b}	22.38^{b}	23.93^{a}	0.44^{**}
Tail length	11.20^{a}	10.47^{ab}	10.66^{ab}	9.40^{b}	0.69^{*}
Nose to tail length	12.20^{ab}	12.00^{b}	12.47^{ab}	13.26^{a}	0.36^{*}

Values with different superscripts in a row differ significantly ($P<0.05$);

The data on the linear body growth parameters of rabbits are presented in Table 3. The inclusion levels of sabara leaf meal in the diets of rabbits resulted in significantly ($P<0.05$) higher body weight than the control group. The increase in body weight across the dietary treatment groups (1-4) observed in this study implied that there is efficient utilization of the feed, since growth rate was generally lower in the control group (T_1) than in bucks fed Sabara leaf meal. This is in agreement with the reports of Hassan (2011) that fed goats with different levels of groundnut haulms. Since all the diets adequately met the recommended nutrients for

growing rabbits, the above effect is very likely caused by SLM since it possesses antibacterial property.

The inclusion levels of SLM in the diets also tend to increase height at withers, heart girth and nose to tail with T_4 (14.20, 23.93, and 13.26cm respectively) being superior to the control. The results of feeding various level of SLM in this study had significant ($P<0.05$) effect on body measurement of rabbits, indicating that an increase in the level of SLM inclusion leads to an increase in the body measurements of the animals. The results of the present study corroborate the findings of Nora and Mukherjee (1997). Tail length was significantly ($P<0.05$) affected by dietary inclusion of SLM, however, it decreases with an increase in the supplementation of SLM in the diet. The non -significant differences ($P>0.05$) observed in the body length, ear length and width of rabbits fed different levels of Sabara leaf meal are indication that the inclusion of the test ingredient up to 30% level does not have deleterious effect on linear growth of the animals. This is in agreement with the work of Ogbuewu *et al*., (2010) where rabbits were fed with Neem leaf meal.

Table 4: The mean live, carcass and relative organ weights of the rabbits fed different levels of SLM inclusion

Treatment (diets)					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**Pooled SEM**
Body weight (g)	1110.00^{b}	868.00^{c}	946.70^{bc}	1433.30^{a}	10.49^{**}
Carcass weight (g)	760.23^{b}	615.75^{c}	686.19^{c}	1187.41^{a}	9.77^{*}
Head weight (g)	71.60^{a}	43.58^{b}	30.23^{c}	74.88^{a}	11.90^{*}
Fat weight (g)	17.65^{a}	14.63^{b}	15.12^{b}	17.42^{a}	3.77^{**}
Kidney weight (g)	3.87^{b}	4.37^{a}	2.43^{c}	4.90^{a}	0.81^{**}
Heart weight (g)	1.28^{bc}	1.68^{b}	3.12^{a}	1.66^{b}	0.66^{*}
Lung weight (g)	3.58^{bc}	3.43^{bc}	11.85^{a}	4.45^{b}	0.73^{*}
Liver weight (g)	18.27	17.98	45.75	20.43	15.04^{NS}
Pancreas weight (g)	0.85^{d}	1.76^{c}	6.55^{a}	2.43^{b}	0.52^{*}
Stomach weight (g)	8.85^{c}	11.92^{b}	36.92^{a}	11.63^{b}	3.46^{*}
Caecum weight (g)	51.67	65.37	69.00	63.00	5.10^{NS}
Colon weight (g)	32.63^{b}	72.67^{a}	29.10^{bc}	83.33^{a}	10.11^{*}
Small intestine weight (g)	244.00	249.00	237.77	236.67	1.93^{NS}
Small intestine length (cm)	18.99	19.12	19.17	18.85	2.95^{NS}
Felt weight (g)	53.37^{b}	64.83^{a}	43.70^{bc}	44.08^{bc}	4.65^{*}

a, b, c, d Values with different superscripts in a row differ significantly SEM = standard error of mean, * = ($P<0.05$), ** = ($P<0.01$), Ns= Not significant

Table 4 shows the mean live, carcass and relative organs weight of the rabbits fed different level of SLM inclusion. The inclusion of SLM in the diet at 30% level did not result in any

significant difference (P>0.05) from the control diet in liver, caecum, small intestine weights and small intestine length. The weight of the head, fat, kidney, heart, lungs, pancreas, stomach, colon and felt of rabbits fed SLM diet were significantly (P<0.05, P<0.01) affected by the dietary treatment. The results indicated in the experiment for cut traits like head, fat, kidney and colon were superior in T4 group to control. However, the values recorded for these traits is lower than the result reported by Ghosh and Mandal (2008) who investigated Soviet chinchilla and Grey giant rabbits. This difference could be due to breed, age and number of organs left with the carcass at slaughter.

Conclusion

Sabara leaf meal can be fed to growing rabbits in their diets and will result in better growth performance. Up to 30% SLM can be included in the rabbit's diet without any adverse effect on growth and performance. This study concluded that the use of Sabara leaf meal may be recommended as a protein and fibre source for rabbits, and that the SLM can be mixed with other feeds and used in compounded ration.

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