E-ISSN: 1115 – 831X P-ISSN: 3027-2963
MPRI-JAVS | INTERNATIONAL JOURNAL OF AGRICULTURAL AND VETERINARY SCIENCE
VOL. 07 NO. 1 - JANUARY, 2025

GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS AND ORGANS PERCENTAGE OF WEANER RABBITS (*Oryctolagus cunniculus*) FED DIETS CONTAINING GRADED LEVELS OF AFRICAN WILD GRAPE (*Lannea microcarpa*) LEAF MEAL

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DOI: https://doi.org/10.70382/mejavs.v7i1.020

Abstract

A feeding trial for 70 days was conducted to evaluate Growth performance and carcass characteristics of weaner rabbits. Five diets were formulated, comprising treatment 1, 2, 3, 4 and 5 at 0%, 5%, 10%, 15% and 20% inclusion levels of African wild grape leaf meal, respectively. Sixty (60) Mongrel weaner bucks' weighing 750 g ± 50 g were randomly allotted into five different treatments consisting four rabbits per replicate and twelve per treatment in a Completely Randomized Design (CRD). Data generated were subjected to the analysis of variance (ANOVA) with Duncan Multiple Range Test to compare the means. Results showed that the growth performance of the

Keywords: African wild grape, Weaner rabbit, Growth, Carcass and Organs

weaner rabbits were not significantly (*P*>0.05) affected among the treatments, except for the final body weight and daily feed intake. The carcass results shows that there were significant (P< 0.05) differences between the treatments in terms of live weight, bladed weight, hind limbs, liver, lungs, loin, ribs, neck, and weight of kidney, caecum and large intestine. African wild grape leaf is found to improved meat quality up to 20% without affecting meat quality.

Introduction

Animal protein production from cattle, sheep and goats requires much capital as compared to the rabbit which has a small body size, short gestation interval and fast-growing rate (Bello and Mikail, 2021). Besides high-quality rabbit meat contains a low level of fat, sodium and cholesterol levels that might be of advantage to the small holder subsistence – type integrated farming, especially in developing countries (Jibril *et al.,* 2014). To improve the protein supply situation in Nigeria, there should be room for improvement, management and selection, the rapid body weight growth, high reproduction rate and good feed efficiency of rabbits and the profitability of rabbit farming, mean that this production enterprise can be attractive to farmers (Galia *et al*., 2023).

In most developing countries, there is a high incidence of protein malnutrition particularly that of animal origin, where it is estimated that on average, only 10 g of animal protein is consumed per day per head compared to 35 g recommended (FAO, 2009). The multiplicity attempts aimed at solving low protein intake and poverty alleviation by the Nigerian government remain illusory (Nworgu and Hammed, 2009). The reasons behind this inadequate intake of animal proteins include the short supply of animal products due to poverty, general economic recession and low level of production of the indigenous breeds of animals (Ogunbosoye and Babayemi, 2010). To improved food production and meet protein requirements in Nigeria, many options need to be explored and evaluated (Owen *et al*., 2008). Livestock species like rabbits; chickens pigeons etc. have a vital role to mitigate the protein deficiency in our local communities (Bello and Mikail. 2021).

Rabbit meat is characterized by its lower energetic value compared with red meats (Dalle, 2004) due to its low fat content. Fat content varies widely depending on the carcass portion from 0.6 to 14.4% (fat from edible meat with intramuscular and intermuscular fat content) with an average value of 6.8% with the loin being the leanest part of the carcass 1.2% of lipids (Hernández and Gondret, 2006). Fatty acid composition of rabbit meat is characterized by high polyunsaturated fatty acid content (Combes, 2004).The amount of cholesterol in rabbit meat is about 59 mg/100 g of muscle, lower values than those presented in meat from other species 61 mg in pork, 70 mg in beef, 81 mg in chicken (Dalle, 2004).

African grapes (*Lannea microcarpa*) or wild grapes commonly known as '*Faaru*' in Hausa, belong to the family *Anacardiacea* (Muhammad *et al*., 2018). It has a proximate composition of protein of 15.313%, fat 5.295%, moisture 9.082%, fibre 14.45% and its found in the savannah zone of West Africa, in Nigeria, it is commonly found in the Northern states of Sokoto, Kebbi, Zamfara, Kaduna, Katsina, Kano and Jigawa (Muhammad 2018). The tree is cultivated commercially on a small scale and can be seen in and around villages, the leaves are used as feed to ruminant animals and the fruit makes an excellent jam or can be made into wine while the pulp is fermented into a potent alcoholic drink (Yunus *et al*., 2013).

MATERIAL AND METHODS

Location of the experiments

The research was conducted at the Teaching and Research Farm of Federal University Dutse, Jigawa State, Nigeria. Dutse is located between latitude 11° 45′ 22.25" and longitudes 9° 20′ 20.26" E, at an altitude of 485 m above sea level (Encarta, 2007). The state is situated within the Sudan Savannah Vegetation Zone, but there are traces of Guinea savannah in the southern region of the State (Olofin *et al.,* 2008). The region is characterized by a long dry season of 7- 8 months and a mean annual rainfall between 600 to 1000 mm with a peak in August. The average of the values minimum and maximum temperatures are 12 and 40 °C respectively and the lowest temperatures occur during the harmattan (November - February) while the highest is from

March to June and the relative humidity of the area ranges from 40 and 78% (Olofin *et al.*, 2008). Sixty (60) buck Mongrel weaner rabbits weighing 750 g ± 50 g were used in this study. The experimental rabbits were acclimatised in the experimental cage for two weeks before the commencement of the experiment. A cage of about 76 cm by 61 cm dimension was thoroughly disinfected and three rabbits were allotted per cage.

Experimental Design

Sixty (60) buck weaner rabbits were randomly allotted into five (5) experimental treatments; each group had four (4) replications with three (3) rabbits constituting a replicate. After balancing for weight, the rabbits were randomly grouped into five (5) dietary treatments in a Completely Randomized Design (CRD).

Sources of Experimental Material

African wild grape leaf was sourced from Jahun Local Government Area, Jigawa State. The fresh leaf was collected and put in sacks and conveyed to the Teaching and Research Farm of Federal University Dutse, air-dried and later milled with a milling machine and bagged for diet formulation. The proximate composition of African Wild Grape Leaf is shown in Table 1.

Statistical Analysis

The data generated from this study was subjected to standardized procedure of the Generalized Linear Model (GLM) of the Statistical Analysis System (SAS, 2013). Significant differences within treatments means were separated using Duncan's Multiple Range Test and the data on sensory evaluation was been evaluated using descriptive statistics.

Table 1: Composition and Calculated Analysis of the Experimental Diet (%)

Ingredient	Experimental diets				
	(T_1) 0%	(T_2) 5%	(T_3) 10%	(T_4) 15%	(T_5) 20%
Maize	43.00	43.00	43.00	43.00	43.00
Soya bean	15.90	15.90	15.90	15.90	15.90
African wild grape leaf	0.00	5.00	10.00	15.00	20.00
Wheat offal	36.60	31.60	26.60	21.60	16.60
Bone meal	3.50	3.50	3.50	3.50	3.50
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Vitamin. Premix	0.30	0.30	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Crude Protein (%)	16.00	16.00	16.00	16.00	16.00
Metabolized Energy(kcal/kg)	2270	2267	2263	2259	2256
Crude Fibre (%)	15.23	19.17	17.90	16.63	15.34
Ether Extract (%)	4.56	4.45	4.98	5.33	5.12

Data Collection

A known quantity of feed was offered in the morning and the leftovers were measured the next morning, the differences were computed daily by subtracting the leftovers from the feed offered in daily feed intake. (DFI = Feed offered – Leftover) The actual body weight was subtracted from the weight of the previous week. BWG = (Actual body weight (g) – Previous body weight). At the end of the experiment, rabbits whose weights were nearest to the average in each replicate were selected, slaughtered and eviscerated. The live weight was taken prior to slaughtering and the dressed weight was also been recorded. The carcass such as hind limbs, forelimbs, ribs, loin and neck, was weighed and recorded while organs including the spleen, kidney, lungs, liver, heart and guts such as caecum, small intestine and large intestine were also weighed and recorded using a sensitive digital electronic scale. The weights were expressed as percentages of respective live weights.

Dressing percentage = $\frac{\text{Carcass weight}}{\text{Live weight}} X100$

% Cut part= $\frac{\text{Cut part}}{\text{Live weight}} X100$

RESULTS AND DISCUSSION

Results

Table 2 shows the growth performance of a weaner rabbit fed diet containing graded levels of African wild grape leaf meal. The average daily gain, feed conversion ratio, initial body weight and live weight gain were not significantly different (P>0.05) between the treatments. The final body weight and daily feed intake differed significantly (P< 0.05). The animals in T5 and T3 had higher final body weight and daily feed intake and T1 and T2 had the lowest value.

Table 2: Growth Performance of Weaner Rabbit Fed Diet Containing African Wild Grape Leaf at Difference graded levels

Parameters	Treatments					
	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)	T_5 (20%)	P-value
DFI	87.5±5.77^{b}	85.7±7.60^{b}	80.5±7.9^{b}	82.3±8.3^{b}	109.8±7.6^{a}	0.030
IBW (g)	770.5±12.9	755.5±24.2	760 ±22.7	745±20.6	760.8±23.1	0.942
FBW (g)	1320±32.2^{b}	1349±19.7^{b}	1394.8±3.6^{a}	1352.5±41^{b}	1397.3±4.8^{a}	0.043
TWG	549.50±49.8	593.50±12.1	634.8±20.1	607.5±38.6	636.5±25.7	0.118
ADG(g)	7.85±0.7	8.48±0.2	9.07±0.6	8.68±0.2	9.09±0.4	0.118
TFI (g/day)	3125±238	3492±232	3156±542	3098±467	3256±791	0.368
FCR	5.69±1.6	5.84±0.7	4.97±0.6	5.09±0.6	5.12±0.2	0.859

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

DFI= Daily Feed Intake, IBW = Initial Body Weight, FBW= Final Body Weight, ADW= Average Daily Gain, TFI= Total Feed Intake, FCR= Feed Conversion Ratio.

Discussion

The daily feed intake recorded in this study was below the range of 136.3 and 149.9 g as reported by Gidenne *et al*. (2019) and higher than the range of 78.7-87.90 g (Baba, 2017). The slight changes indicated that the experimental material had significance effect to the experimental animal. The daily weight gains among the treatments were within the range of 7.48 to 10.91 g as reported by Mohammed *et al*.(2011). The higher weight gain detected in rabbits placed on T3 and T5 could be due to the nutritive quality of the

experimental diet as reported by Doris *et al*. (2024). The feed conversion ratio of all the treatments (2.46±0.63-5.84±0.65) were lower than the range of 5.01-16.25 (Bello and Mikail 2021).

Results

The carcass characteristics and cut-up parts and organs of the weaner rabbit fed diet containing graded levels of African wild grape leaf meal. were presented in Table 7. The results show that there were no significant difference in the carcass dressing, carcass weight, head, forelimbs, spleen, heart and small intestine ($p > 0.05$), but there were significant ($p < 0.05$) difference in the live weight, bladed weight, hind limbs, liver, lungs, loin, ribs, neck, kidney and caecum between the treatments. The rabbits in the T5 had higher value while those in T1 had a lowest value across the treatments.

Table 3: Carcass Characteristics and Cut Organs of Weaner Rabbit Fed Diet Containing Graded Levels of African Wild Grape Leaf Meal.

Parameters	Treatments					
	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)	T_5 (20%)	P -Value
Live weight (g)	1320±30.9^{b}	1349±19.7^{a}	1394.75±3.6^{a}	1355±43^{a}	1397±4.8^{a}	0.0009
Bladed weight(g)	1308±32.58^{b}	1331.±19^{b}	1370.±4.59^{a}	1333.±40^{b}	1376±5.5^{a}	0.0089
Carcass wght (g)	622.50±6.20	652.50±18	680.75±22.7	685±16.5	673±11.9	0.1243
Carcass drss (%)	47.2±0.89	48.4±0.78	48.8±0.63	50.6±0.84	48.2±0.65	0.2280
Cut up (%)						
Head	9.26±0.23	9.25±0.23	8.46±0.22	9.18±0.09	8.84±0.24	0.2449
Neck	2.1±0.03^{c}	2.9±0.06^{a}	2.8±0.06^{a}	2.9±0.03^{a}	2.8±0.03^{b}	0.0001
Hind limbs	10.3±0.55^{a}	6.6±0.07^{b}	6.4±0.06^{b}	6.8±0.14^{b}	6.5±0.03^{b}	0.0001
Forelimbs	7.4±0.46	7.1±0.13	7.1±0.08	7.4±0.07	7.4±0.28	0.8294
Ribs	9.0±0.61^{a}	9.4±0.71^{a}	7.5±0.11^{b}	8.2±0.11^{a}	8.1±0.11^{a}	0.0444
Loin	7.6±0.17^{a}	5.6±0.11^{b}	5.9±0.11^{b}	5.7±0.01^{b}	5.6±0.21^{b}	0.0019
Organ weight (%)						
Spleen	1.35±0.02	1.38±0.03	1.38±0.04	1.42±0.03	1.35±0.03	0.5224
Kidney	10.8±0.85^{b}	11.8±0.48^{a}	11.8±0.48^{a}	13±0.70^{a}	13±0.63^{a}	0.0250
Lungs	12.3±0.63^{b}	14.3±0.63^{a}	15±0.41^{a}	15±0.75^{a}	15±0.29^{a}	0.0152
Liver	39±1.43^{b}	46±1.93^{a}	46±1.32^{a}	45±1.85^{a}	46±1.38^{a}	0.0437
Heart	4.23±0.29	4.28±0.28	4.33±0.30	3.88±0.33	4.12±0.33	0.4723
Guts						
Caecum	3.6±7.12^{a}	2.5±0.95^{b}	2.5±1.78^{b}	2.7±1.18^{a}	2.6±1.44^{a}	0.0106
Small intestine	18±91.17	18.7±4.55	18.2±4.19	18.2±5.12	18.1±5.93	0.4819
Large intestine	4.7.±6.60^{b}	5.9±4.23^{a}	6.3±1.89^{a}	6.4±1.08^{a}	6.2.±1.29^{a}	0.0008

[abc] Means with different superscripts within the same row are significantly different ($p < 0.05$).
drss= dressing.
wght = weight

Discussion

Carcass weight increased with increasing levels of African wild grape leaf across the diets, except in T5. These values were comparable to 497.70 - 727.65 g as reported by Abubakar *et al*. (2015) who fed weaner rabbits with *Moringa oliefera* leaf. The dressing percentage obtained in this study was lower than the range of 55.30-67.45% as reported by Bello and Mikail (2021) this may be attributed to the higher proportion of organs and bones which can decrease the dressing percentage. The values obtained for the weight of the heart were similar to the range of 3.90-4.15g as reported by Ozung *et al*. (2019). This indicated that the experimental animals were at an optimal body condition with a healthy balance of muscle, fat and other tissues. The weight of the liver in this study is comparable to the 42.30-53.40 g reported by Odeyinka *et al*. (2011) for weaner rabbits fed soybean milk residue, cowpea testa and corn starch residue in diets. Higher values of liver weight could be an indication of the extent of its involvement in feed digestion and metabolism (Kamalak *et al*., 2005). The weight of the lungs, heart and kidney were comparable to the values reported by Abubakar *et al.* (2015). Some measurements which included the small intestine, spleen, forelimb and heart were not affected by the diet (Henry *et al*., 2013.) The finding in the present study indicated immune system (spleen) is robust and able to function normally despite dietary changes, cardiovascular system (heart) is healthy and able to maintain normal function, digestive system (small intestine) can absorb nutrients efficiently and muscle skeletal system (forelimb) is strong and able to maintain normal function (Kamalak *et al*., 2005).

CONCLUSION

The study concluded that African wild grape is found to improved meat quality up to 20%.

RECOMMENDATIONS

1. African wild grape leaf can be used as a nutritious feed supplement for rabbits, improving growth rate as it can supplemented up to 15-20% without any adverse effects.
2. Rabbits fed African wild grape leaf had improved carcass characteristics such as increased dressing percentage at 15-20% inclusion levels of the diet.

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