CARCASS CHARACTERISTICS OF RABBITS FED *Gomphrena celosioides* BASED – DIETS

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ABSTRACT
This study evaluated the carcass characteristics of rabbits fed globe amaranth (Gomphrena celosioides) based – diets. Forty growing rabbits with average initial weight (1500±0.02g/rabbit) were randomly allotted to five treatments after equalizing for body weight and sex in a completely randomized design, with eight rabbits per treatment. Diets were designated as T_1, T_2, T_3, T_4 and T_5 with inclusion levels of Globe Amaranth Leaf Meal (GALM) at 0, 5, 10, 15 and 20%, respectively. The feeding trial lasted 20 weeks after the initial two weeks adjustment period. At the end of the trial, six rabbits (3 bucks & 3 does) per treatment whose weight were equal or closed to the mean weight per treatment were selected, starved of feed but had access to drinking water for 12 hours, before the animals were slaughtered for carcass evaluation. The live weight at slaughter was determined shortly before the rabbits were killed by exsanguination, followed by evisceration and determination of carcass cuts. Results showed no significant ($p>0.05$) effect of diets on the average dressed weight (1046.67-1216.67 g/rabbit), dressing percentage (57.09 – 64.60 %), visceral organs and gastro-intestinal tract morphometry. However, dietary treatments had significant ($p<0.05$) effect on the relative weight of loin (4.44-7.61%), back cut (6.27 – 7.72%) and thigh/hind limbs (13.78 – 16.48%). The dietary trend showed a positive effect on the carcass characteristics up to 15% GALM level. The study concluded that farmers can include globe amaranth leaf meal at levels not exceeding 15% in rabbit diets without compromising the carcass (meat quality) characteristics.
Keywords: Anti-nutrients, Carcass, Rabbit, Globe amaranth, Viscerals

INTRODUCTION

The domestication of animals and their integration with crop agriculture has provided the main avenue for agricultural intensification, and this in turn, has allowed for unprecedented economic and human population growth. The increasing population generally, depends on available food resources, contributing to the strain on food supply for both man and animals. Efforts to manage this problem will result in utilization of non-conventional feedstuffs, which include forages, kitchen by-products and other lesser-known feed materials. Feeding of forages to rabbits allows for better growth rate and feed efficiency (Ironkwe and Ukanwoku, 2016). There are various forages used by farmers for rabbit production, including *Gomphrena celosioides*.

Gomphrena celosioides commonly known as globe amaranth is an herbaceous annual plant of the family amaranthaceae. In Nigeria, it is used in ethno - medical practices for the treatment of various skin diseases and worm infection. It grows along road sides, river banks, old construction sites and fallow lands. Globe amaranth can be used as a leaf meal for feeding rabbits which could be an ideal alternative for synthetic growth promoters in animal production. Ekpo (2021) reported that globe amaranth leaf meal is rich in minerals; the nutrient composition revealed 95.40% dry matter, 16.05% CP, 31.15% CF, 5.06% ash, 8.75% EE and 38.99% NFE. It is also rich in Vitamins A (424.51 mg/g), B (0.76 mg/g; C (30.57 mg/g), D (0.12 mg/g), E (0.20 mg/g) and K (0.01 mg/g). Though, with some anti nutrients like tannin (0.54 %), phytates (0.85 %), oxalate (1.07 %), saponin (0.95 %) and hydrogen cyanide (0.66 %) which are minimal and effects may wear off while processing the leaf meal (Obua *et al*.,2012). Report by Ekpo (2021) also showed that globe amaranth leaf meal has 16.44 mg/g phytates, 37.09 mg/g saponins, 5.40 mg/g tannins and 13.34 mg/g trypsin inhibitors. The nutrient profile makes the leaf meal appropriate for feeding rabbits (Hall, 2010).

The rabbit (*Oryctolagus cuniculus*) is a micro livestock; whose production is one of the cheapest and easiest ways of producing high quality animal protein, for the ever-increasing human population. Rabbits are prolific and being herbivores can survive and convert cheap fodder into animal protein for human consumption. Rabbits can also convert protein in cellulose-rich plants which is not economical as feed for poultry. Forages supply protein and energy as well as fibre which aid digestion in rabbits as they have ability to properly digest leaf protein (Akinmutimi and Obioha, 2010). However, there is paucity of satisfactory research findings on the utilization of globe amaranth leaf meal in rabbit feeding trials. This study was therefore designed to determine the carcass characteristics of rabbits fed dietary levels of *Gomphrena celosioides* leaf meal based – diets.

MATERIALS AND METHODS

The study was carried out at the Rabbitry Unit of the Teaching and Research Farm, University of Calabar, Calabar. Fresh globe amaranth leaves were harvested within the University staff quarters; air dried to constant weight in order to maintain the green colour before milling. Milled samples were stored in air-tight containers for use in feed formulation. Five experimental diets were formulated and Globe Amaranth Leaf Meal (GALM) was included at 0, 5, 10, 15 and 20% for treatments T1, T2, T3, T4 and T5, respectively. The gross composition of experimental diets is presented in Table 1. Forty growing mixed breed rabbits aged between 6 and 8 weeks old, with a mean body weight (1500±0.02g) were used in this study. The rabbits were weighed and randomly assigned to five groups in a CRD experiment after weight and sex equalization. Each dietary treatment comprised eight (8) rabbits. The rabbits were intensively managed in wooden cages. Clean drinking water was provided *ad libitum* throughout the feeding trial of 60 days, excluding the 14 days initial acclimatization period to the facility. At the end, 6 rabbits (3 bucks and 3 does) per treatment whose individual weight were equal or closed to the mean weight per treatment were selected for carcass evaluation. Slaughter weight was determined and each animal eviscerated with all the viscerals removed *intoto*. Carcass weight was determined prior to further dissection into prime cuts. The gastro - intestinal tract (GIT) was obtained and cleaned of all adhering meninges. Digestive and internal organs (oesophagus, liver, pancreas, kidney, heart, spleen and lungs) were carefully separated and weighed using an electronic scale. Total GIT as well as length and weight of segments were determined. Data obtained were subjected to one - way analysis of variance using GenStat Release 10.3 statistical package. Significance means were separated using the least significance difference (LSD) method (Steel and Torrie, 1980).

Table 1: Gross composition of experimental diets

Ingredient	T1 (0 % GALM)	T2 (5 % GALM)	T3 (10 %GALM)	T4 (15 % GALM)	T5 (20 % GALM)
Yellow maize	44.00	44.00	44.00	44.00	44.00
GALM	0.00	5.00	10.00	15.00	20.00
SBM	15.80	15.80	15.80	15.80	15.80
Rice husk	12.50	12.50	12.50	12.50	10.50
Wheat offal	20.00	15.00	10.00	5.00	3.50
PKC	3.00	3.00	3.00	3.00	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Crayfish dust	2.00	2.00	2.00	2.00	2.00
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Determined analysis:					
%CP	16.00	16.14	16.43	16.57	16.71
%CF	8.06	8.06	8.17	8.23	8.27
ME (Kcal/kg)	2448.85	2487.85	2525.85	2585.85	2591.21

RESULTS AND DISCUSSION

The carcass characteristics of rabbits fed globe amaranth leaf meal based-diets are presented in Table 2. The live and dressed weights recorded an undulating pattern, while the dressing percentage recorded decreased trend as GALM inclusion level increased. The live weight (1833.33 -2016.67 g/rabbits) was within the range (1700-2213g/rabbits) reported by Fatufe *et al*. (2010) who fed diets containing bacterial protein; and Adeyemi (2014) who fed moringa leaf meal as well as Akinmoladun *et al*. (2018) who fed *Tridax procumbens;* but higher than 1733 – 1980g reported by Akinmutimi and Obioha (2010) who fed Globe amaranth leaf meal to rabbits. The dressed weight (1046.67 -1216.67g) was slightly higher than 497.00-1164.00g reported by Akinmutimi and Obioha (2010), who fed GALM; and Abubakar *et al*. (2015) who fed moringa leaf meal to rabbits. The dressing percentage (57.09-64.10%) obtained was within the range (62-67%) reported by Ozung *et al*. (2011) who fed cassava peel meal diets to rabbits, but was higher than the range (42.49-45.96%) reported by Abubakar *et al*. (2015) who fed moringa leaf meal to rabbits. Differences occurred because the heads were removed from the carcasses in this study; as the head, skin and feet of rabbits contribute about 10,11 and 3% respectively to the dressing percentage (Aduku and Olukosi, 1990). The increased trend recorded for live weight and dressed weight indicated the effect of diets, while Oteku and Igene (2006) reported that increased carcass parameters could be as a result of increased age of the animal or effects of diets. The carcass cuts of rabbits fed GALM based-diets, recorded no significance difference ($p>0.05$) for most of the parameters except for the back cut, thigh and loin

which were significantly affected ($p<0.05$). The non-significant effect implies that the antinutrients in GALM were within a tolerable range. Values obtained for the heart recorded a fluctuating trend with the range (0.16 –0.26%) lower than (0.33- 0.46 %) reported by Shaahu *et al*. (2016), but within the range (0.21- 0.28%) reported by Akinmoladun *et al*. (2018). The relative weight of liver (1.38- 2.23 %) was within the range (2.31- 3.04 %) reported by Ozung *et al*. (2011) and Akinmoladun *et al*. (2018), but higher that range (1.01- 1.34 %) reported by Adeyemi (2014) and lower than (3.87- 4.20 %t) reported by Akinmutimi and Obioha (2010). The differences observed may be due to breed, sex, age at slaughter and different test ingredients used in the separate studies. A fluctuating decreased pattern indicated that the anti-nutrients in globe amaranth leaf meal were within a tolerable range as such no adverse effects were noticed on any of the organs. The GIT morphometry of rabbits recorded no significant ($p>0.05$) difference for the weight. The non-significant effect indicates that anti nutrients present in GALM were within tolerable range. The relative weight of oesophagus (0.09-0.25 %) obtained was within the range (0.08-0.32 %) reported by Ochefu *et al*. (2020) who fed ginger meal to rabbits. The relative weight of the stomach (1.00-1.23%) was higher than (1.47-5.28%) reported by Ochefu *et al.* (2020). The respective length of colon, caecum and appendix increased with dietary GALM, indicating that fibre in the diets may have exerted a positive tissue formation in the linings of these organs to withstand digestive dysfunction due to some antinutrients toxicity.

Table 2: Carcass and organ characteristics of rabbits fed globe amaranth leaf meal-based diets

Parameter	T1	T2	T3	T4	T5	SEM
Live weight (g/rabbit)	1833.33	1883.33	2016.67	1900.00	1833.33	42.28
Dressed wt.(g/rabbit)	1176.67	1216.67	1213.33	1120.00	1046.67	27.64
Dressing %	64.18	64.60	60.17	58.95	57.09	2.28
Rel. wt. (% LW):						
Head	8.13	8.21	7.59	7.63	7.67	3.87
Neck	2.42	2.12	2.14	2.21	1.89	2.11
Shoulder/forelimb	9.95	10.50	10.76	9.00	9.55	14.34
Back cut	7.72^{a}	7.45^{a}	6.77^{ab}	6.39^{ab}	6.27^{ab}	11.53
Loin	5.79^{ab}	5.08^{b}	7.61^{a}	4.44^{b}	6.91^{ab}	7.69
Thigh/hindlimb	15.76^{ab}	14.82^{ab}	16.48^{a}	13.78^{b}	14.49^{b}	7.36
Rack	8.13	7.84	6.56	6.61	6.27	7.19
Liver	2.11	2.23	2.15	1.95	2.18	1.38
Heart	0.22	0.20	0.23	0.26	0.16	0.27
Pancreas	0.40	0.53	0.30	0.40	0.31	0.88
Spleen	0.04	0.05	0.05	0.05	0.07	0.98
Lungs	0.71	0.67	0.76	0.65	0.45	0.97
Kidneys	0.56	0.58	0.53	0.53	0.49	0.37
Gall bladder	0.07	0.04	0.05	0.09	0.07	0.71
Visceral fat	1.32	1.17	1.49	0.88	0.62	2.58
Oesophagus	0.09	0.11	0.10	0.11	0.25	0.27
Stomach	1.00	1.09	1.32	1.09	1.20	1.12
Small intestine	2.31	2.22	2.19	2.53	2.93	1.96
Colon	0.72	0.74	0.75	0.78	0.73	2.33
Caecum	3.78	3.97	4.10	5.03	3.96	3.97
Appendix	0.29	0.27	0.38	0.41	0.38	0.48
Total GIT rel. wt.	8.10	8.40	8.84	9.95	9.45	6.06
Oesophagus length (cm)	11.80	9.67	9.17	9.50	16.33	3.28
Stomach length (cm)	9.67	16.50	26.03	22.67	25.13	2.58
Small int. length (cm)	259.00	313.30	263.67	196.50	288.33	17.71
Colon length (cm)	31.33	36.83	32.00	28.67	27.00	1.35
Caecum length (cm)	31.00	30.67	33.17	37.30	32.77	1.05
Appendix length (cm)	9.50	9.16	9.43	10.00	9.83	0.25
Total GIT length (cm)	352.30	416.13	373.47	304.64	399.39	37.87

[a,b]Means on the same row with different superscripts are significantly different ($p<0.05$)

CONCLUSION

The study concluded that farmers can include globe amaranth leaf meal at levels not exceeding 15% in rabbit diets without compromising the carcass (meat quality) characteristics.

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