FEEDING RESPONSE OF GROWER RABBITS ON SELECTED HYDROPONICALLY GROWN FODDERS

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ABSTRACT

This study assessed the growth performance and nutrient utilization of grower rabbits fed selected tropical cereals grown in a locally adapted hydroponic chamber namely: maize (Zea mays), millet (Pennisetum glaucum), sorghum (Sorghum bicolor) and wheat (Triticum aestivum). A total of forty (40) grower rabbits employed for this study, were randomly assigned to five dietary treatments (n = 8 rabbits per group), where Diet 1 is the control with conventional rabbit concentrate diet. The other four (4) treatments were fed hydroponically grown sorghum, maize, millet and wheat which serve as Diets 2, 3, 4 and 5 respectively. The experiment lasted for 8 weeks. Chemical composition of the treatment diets was carried out following standard laboratory procedures. Results indicated a reduction (P<0.05) in the dry matter and ether extract of the hydroponically grown fodders compared to the control diet while a significant (P< 0.05) increase was observed for crude fibre. The results also revealed that the average daily gain and feed efficiency of rabbits on Diets 2 and 3 were comparable (P > 0.05) to those on the control diet. What is your recommendation?

Keywords: Cereals, Concentrate, Hydroponic fodders, Growth performance, Rabbits.

INTRODUCTION

The need for continuous access to quality feed all year round is essential for the sustainability of any livestock production enterprise. The major problem of grazing livestock in the tropics, is its heavy dependence on natural grasslands whose availability and nutritional value is seasonal and shrinking. Year – round supply of feed is still a major challenge for livestock production in the humid tropical country such as Nigeria. As such, exploring any technology that will encourage the reduction in cost of production of high-quality forages within limited space would go a long way in resolving these perennial crises (Odedire, 2018). Furthermore,, promoting livestock with short generation interval such as rabbits, will be a viable alternative during the season of forage unavailability. One of such technological advancements in forage production is the utilization of hydroponically grown fodders (HGFs) in livestock feeding. Rabbits are efficient converter of forage into good quality animal protein, with short generation interval and high prolificacy (Usha and Suganthi, 2023). The meat is high in protein (22%) and low in fat (4%) and cholesterol (5%) (Aduku and Olukosi, 2000). Hydroponic fodder production is a technology of growing fodder without soil, using only water or nutrient-rich solution. Hydroponic fodder presents various benefits ranging from improved animal health to highly enriched nutritional contents (Girma *et al.,* 2018). Feeding hydroponically grown fodder has also been reported to enhance nutrient digestibility and utilization in animals (Hassen *and David,* 2022). The objective of this study therefore, was to assess the growth performance and nutrient digestibility of grower rabbits fed hydroponically grown fodders.

MATERIALS AND METHODS

Production of hydroponically grown fodders

A locally adapted hydroponic chamber (Odedire, 2018) was employed for the purpose of this experiment. Four (4) cereals namely, Maize (*Zea mays*), Millet *(Pennisetum glaucum*), Wheat (*Triticum aestivum*) and Sorghum (*Sorghum bicolor*) were all subjected to soaking durations of 90 minutes except for millet, that was soaked for 30 minutes (Adekanye, unpublished). After 9 days of total growth period, the fodders were harvested, weighed and fed to the grower rabbits.

Growth performance trial

The experiment was carried out at the Rabbitry Unit of the Teaching and Research Farm, Obafemi Awolowo University Ile-Ife, Nigeria. Forty (40) grower rabbits weighed (1.00 ± 0.50kg) were housed individually in a battery cage production system for ease of individual data collection. Animals were dewormed and were allowed to acclimatize for 14 days, after which they were weighed before the trial and were randomly allotted to five dietary treatments (n=8). Data were collected on daily feed intake and weekly body weight (BW) in the 56-days trial. Average daily gain (ADG) g/day, total weight gain and feed conversion ratio were calculated from data collected.

Experimental diets and Feeding

Five dietary treatments employed were: a typical rabbit growers' concentrate diet (control - diet 1); hydroponically grown sorghum (Diet 2); hydroponically grown maize (Diet 3); hydroponically grown millet (Diet 4); hydroponically grown wheat (Diet 5). Animals were offered diet 4% of their BW in the morning and water was provided *ad-libtum* through nipple drinkers attached to the cages

Chemical Analyses
Alliquot samples of feed were dried in an oven (at 70˚C) for 72 hours to obtain dry matter and were analyzed in ***triplicates*** for proximate composition and fibre fractions (AOAC, 2006;Van Soest *et al.,* 2015).
Experimental design and Statistical model:
This experiment was laid out in a completely randomized design (CRD) with this statistical model.

$y_{ij} = \mu + t_i + \varepsilon_{ij}$

where: y_{ij} = observation of subject (rabbit) 'j' in treatment 'i'

μ = the overall mean

t_i = fixed effect of dietary treatment i,

ε_{ij} = Random error.

Statistical Analyses
Data collected were subjected to a One - way analysis of variance analysed using the General Linear Model (GLM) procedure of SAS (2001) package. Significant (P< 0.05) differences between means were separated using the Duncan's Multiple Range Test of the same package.

RESULTS AND DISCUSSION
Presented in Table 1 is the chemical composition of the hydroponically grown fodders with the concentrate diet serving as a control. The dry matter (DM) content and ether extract in Diet 1 was significantly (P<0.05) higher than other diets., This is because Diet 1 is a conventional concentrate diet with high dry matter content as reported by Naik *et al*. (2015) while Diets 2, 3, 4 and 5 were HGFs. HGFs are reported to contain low DM as a result of sprouting in starch, which catabolizes into soluble sugar for supporting the metabolism requirement of growing plants for respiration and cell wall synthesis (Naik *et al*., 2015; Odedire *et al*., 2019). The crude protein (CP) value (20.75%) obtained for this study was highest in Diet 2 which is the hydroponically grown sorghum. The Neutral detergent fibre (NDF) was significantly higher (P<0.05) in HGFs diets than the concentrate diet. Acid detergent fibre (ADF) was highest in Diet 3 (hydroponically grown maize). Chetan *et al*., 2022 reported lower values for NDF (33%) and ADF (15.5%) in hydroponically grown maize compared to the 66.51% NDF and 49.92% ADF obtained in this study. The higher ADF and NDF may be attributed to the increase in the number and size of cell walls for the synthesis of structural carbohydrates.
Table 2 shows the growth performance of grower rabbits fed the experimental diets. Rabbits on Diets 1 and 2 consumed more feed (P< 0.05) than others, as reflected in their values of Average daily feed intake (ADFI), which suggests Diets 1 and 2 may be more palatable to the animals. The values of the Average daily gain and Total weight gain recorded for rabbits on Diets 1 and 2 were superior (P< 0.05) to those on other diets, except for Diet 3 (P>0.05).

Table 1: Chemical Composition of the Experimental Diets

	Diets						
Parameters (%)	**1**	**2**	**3**	**4**	**5**	**SEM**	***P* value**
Dry Matter	93.96^a	23.14^b	18.81^c	22.95^b	17.12^d	7.88	<0.0001
Ether Extract	6.34^a	4.42^b	3.52^d	4.12^c	3.37^e	0.28	<0.0001
Crude Fibre	9.00^e	19.44^c	23.17^a	21.68^b	17.78^d	1.33	<0.0001
Ash	8.68^b	7.85^c	9.37^a	7.70^d	6.69^e	0.24	<0.0001
Crude Protein	18.35^c	20.75^a	17.82^d	19.10^b	15.68^e	0.44	<0.0001
Nitrogen free Extract	57.49^a	47.55^c	46.13^d	47.41^c	56.49^b	1.32	<0.0001
			Fibre fraction				
Neutral detergent fibre	12.04^e	61.63^c	66.51^a	62.08^b	53.29^d	5.34	<0.0001
Acid detergent fibre	4.59^e	44.36^c	49.92^a	45.12^b	36.17^d	4.36	<0.0001
Acid detergent lignin	0.98^e	11.26^c	14.25^a	11.62^b	11.15^d	1.22	<0.0001
Hemicellulose	7.45^e	17.27^a	16.59^d	16.96^c	17.12^b	1.02	<0.0001
Cellulose	3.62^e	33.10^c	35.67^a	33.50^b	25.02^d	3.17	<0.0001

a, b, c, d: Means within each row with different superscript are significantly different (p< 0.05) SEM (±): Standard error of mean; P value: Probability value; Diet 1: concentrate (control); Diet 2: hydroponically grown sorghum; Diet 3: hydroponically grown maize; Diet 4: hydroponically grown millet; Diet 5: hydroponically grown wheat.

The ADG value recorded for maize in this study is similar to that reported growth by Jemimah *et al*. (2008) where the authors obtained ADG value of 13.66g/day. The lower ADG obtained for rabbits on Diets 4 and 5 may be attributed to the quality of the seeds during germination. Overall, the Feed conversion ratio (FCR) of the diets were similar (P> 0.05) except for Diet 5, which can be attributed to the poor quality of the wheat employed for the experiment, since all the cereals were procured from the local market.

Table 2: Growth Performance of Grower Rabbits fed the Experimental Diets

	Diets						
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM**	***P* value**
Initial weight (kg)	1.26	1.44	1.26	1.26	1.26	0.04	0.5200
Final weight (kg)	2.01^{ab}	2.18^{a}	1.94^{bc}	1.82^{bc}	1.77^{c}	0.04	0.0011
Total weight gain (kg)	0.75^{a}	0.74^{a}	0.68^{ab}	0.56^{b}	0.51^{b}	0.03	0.0131
ADG (g/day)	13.42^{a}	13.32^{a}	12.19^{ab}	9.93^{b}	9.14^{b}	0.52	0.0131
Total feed intake (g)	3407.3^{a}	3466.0^{a}	2775.5^{b}	2693.9^{b}	3044.6^{ab}	82.38	0.0028
ADFI (g/day)	60.84^{a}	61.89^{a}	49.56^{b}	48.11^{b}	54.37^{ab}	1.47	0.0028
FCR	4.67^{b}	4.95^{b}	4.50^{b}	4.96^{b}	6.29^{a}	0.24	0.0472

$^{a, b, c}$: Means within each row with different superscript are significantly different (p< 0.05); SEM = Standard error of mean; P value = Probability value; ADG: Average daily gain; ADFI: Average daily feed intake; FCR: Feed conversion ratio; Diet 1: concentrate (control); Diet 2: hydroponically grown sorghum; Diet 3: hydroponically grown maize; Diet 4: hydroponically grown millet; Diet 5: hydroponically grown wheat

Table 3 shows the apparent nutrient digestibility of grower rabbits fed the experimental diets. Dry matter intake and dry matter digestibility are said to be dependent on the cell wall constituents, especially neutral detergent fibre, acid detergent fibre and lignin (Bakshi and Wadhwa, 2004). The dry matter digestibility recorded in this study was high in Diet 1 compared to other diets. However, there were reports of decreased DM intake in animals fed hydroponically grown fodders (Fazaeli *et al*., 2011). Compared to other hydroponic fodders, sorghum (Diet 2) showed better performance (P< 0.05) in terms of DM, CP, CF and Ether extract, as most of the values recorded for Diet 2 are comparable to that of the Concentrate (Diet 1). Digestible CP recorded for Diets 1 and 2 are close to the value of 71.4% reported for hydroponic barley fed to sheep (Devendra *et al*., 2020). The high fibre fraction digestibility in Diets 1 and 2 indicates a better utilization of the available energy b*y* the rabbits, which will enhance their growth performance.

Table 3: Apparent Nutrient Digestibility of Grower Rabbit fed Experimental Diet

	Diets						
Parameters (%)	**1**	**2**	**3**	**4**	**5**	**SEM**	***P* value**
Proximate Composition							
Dry matter	54.20^{a}	42.58^{b}	20.33^{d}	28.55^{cd}	36.78^{bc}	3.40	0.0006
Crude protein	72.49^{a}	66.70^{ab}	35.27^{c}	63.04^{b}	23.41^{d}	5.26	<0.0001
Crude fibre	44.49^{bc}	54.91^{a}	44.20^{bc}	46.52^{b}	42.19^{c}	1.28	0.0002
Ether extract	84.65^{a}	75.45^{b}	57.57^{d}	69.65^{c}	62.48^{d}	2.63	<0.0001
Ash	24.69	25.01	27.56	26.54	27.48	1.38	0.9614
NFE	65.57^{a}	48.75^{bc}	41.96^{c}	42.28^{c}	56.99^{ab}	2.65	0.0006
Fibre fraction							
NDF	41.80^{a}	34.83^{a}	13.76^{b}	21.45^{b}	22.03^{b}	3.06	0.0025
ADF	28.67^{a}	28.86^{a}	6.01^{c}	19.73^{ab}	10.89^{bc}	2.76	0.0016
Hemicellulose	22.94^{b}	41.73^{a}	27.33^{b}	25.74^{b}	23.65^{b}	2.09	0.0025
Cellulose	14.78^{d}	43.35^{a}	34.70^{b}	34.46^{b}	25.22^{c}	2.63	<0.0001
ADL	18.75^{a}	13.44^{b}	14.54^{b}	15.27^{b}	13.04^{b}	0.61	0.0022

$^{a, b, c, d}$: Means within each row with different superscript are significantly different (p< 0.05); SEM = Standard error of mean; P value = Probability value; Diet 1: concentrate (control); Diet 2: hydroponically grown sorghum; Diet 3: hydroponically grown maize; Diet 4: hydroponically grown millet; Diet 5: hydroponically grown wheat

CONCLUSION

Rabbits fed hydroponically grown sorghum compared well with those on the Concentrate diets and can conveniently be fed to grower rabbits without any deleterious effect.

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