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Preface

We would like to present, with great pleasure, the inaugural volume-9, Issue-3, March 2023, of a scholarly journal, *International Journal of Engineering Research & Science*. This journal is part of the AD Publications series *in the field of Engineering, Mathematics, Physics, Chemistry and science Research Development*, and is devoted to the gamut of Engineering and Science issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

This journal was envisioned and founded to represent the growing needs of Engineering and Science as an emerging and increasingly vital field, now widely recognized as an integral part of scientific and technical investigations. Its mission is to become a voice of the Engineering and Science community, addressing researchers and practitioners in below areas

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Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within that community who supported the idea of creating a new Research with IJOER. We are certain that this issue will be followed by many others, reporting new developments in the Engineering and Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IJOER* readers and will stimulate further research into the vibrant area of Engineering and Science Research.

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Apparanet Nutrient Digestibility and Cecal Parameters of Rabbits Fed Concentrate with Guinea Grass (Panicum Maximum) and Purple Velvet (Gynura Aurantiaca)

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Abstract— *A study was conducted to determine the apparent nutrient digestibility and cecal parameters of grower rabbits fed concentrates with Panicum maximum and Gynura aurantiaca. A total of 24 New Zealand rabbits were used for the study and were randomly assigned to four (4) dietary treatments of T1, T2, T3 and T4 in a Completely Randomized Design (CRD) with six (6) animals per treatment. They were subjected to varying ration of 100% concentrates (C) for the control, 50% concentrate + 50% of Pannicum maximum (C+G) for T2, 50% concentrate + 50% of Gynura aurantiaca for T3, and 50% of concentrate + 25% of Pannicum maximum + 25% of Gynura aurantiaca for T4. Nutrient digestibility and cecal parameters were analyzed at the end of the experimental trial. The result from the study showed significant (P<0.05) difference on crude protein digestibility, dry matter digestibility, crude fat digestibility, ash digestibility, crude fibre digestibility, and nitrogen free extract digestibility. Thus, rabbits fed 50% concentrate+25% guinea grass+25% purple velvet showed superior values for crude protein digestibility, dry matter digestibility, and nitrogen free extract digestibility, with respect to other groups. Crude fat digestibility, and crude fibre digestibility were statistically highest among rabbits fed 50% concentrate+50% purple velvet when compared to other treated groups. Also, rabbits fed the control diet and those fed 50%concentrate + 50% Gynura aurantiaca recorded similar values that were statistically highest when compared to others. Furthermore, the cecal pH and NH_3 were significantly (P<0.05) influenced by the test diet with the superior value of cecal pH recorded among rabbits fed 50% concentrate+25% guinea grass+25% purple velvet with low values of NH_3 when compared to other treated groups. Thus, the research recommends that equal mixture of concentrate at 50%+ 25% Guinea grass +25% of Gynura aurantiaca in treatment 4 should be adopted due to their promising potentials from the parameters analyzed.*

Keywords— Cecal parameters, Concentrate, Guinea grass, Nutrient Digestibility, Purple velvet, Rabbits.

I. INTRODUCTION

1.1 Description of problem

Rabbits have been recognized to play an important role to Nigerians especially in the rural and peri-urban areas because they have different converters of feed to meat and can utilize up to 30% crude fibre as against 10% by most poultry species (1). Despite the promising potential of the rabbit as meat and for production of animal protein, factors like scarcity of feed ingredients and poor nutrient digestibility limit their sustainability (2). As earlier reported by (3 and 4), the nutritional status from most of the conventional feed available to the rabbits have been compromised despite their rising cost. This means that the expectations from most rabbit farmers have been jeopardized owing to poor digestibility of the available nutrients. (5) buttressed that such cases make economic losses inevitable to the rabbitry owners. It's within this context that elicited an explosion of interest to search for an alternative feed source that can produce an economically viable end results in a relatively short period (6). Forages (*Panicum maximum* and *Gynura aurantiaca*) are readily available and cheap in the tropics, and rabbits, being pseudo ruminants have the ability to utilise forages for growth. (7) confirmed from his study that it was economical to raise rabbits on mixed diet of concentrate and forage. This means that it is feasible to ameliorate the menace in rabbit production by supplementing concentrates with *Panicum maximum* and *Gynura aurantiaca* that are nutritious and palatable. It is therefore within this assertion that the study was carried out. The objective of the study was to evaluate the apparent nutrient digestibility and cecal parameters of grower rabbits fed concentrates with *Panicum maximum* and *Gynura aurantiaca*.

II. MATERIALS AND METHODS

2.1 Experimental Site and durations

This study was conducted at the Rabbitry unit of University of Port Harcourt Research and Demonstration Farm, Choba, Rivers State. The experiment lasted for 8 weeks.

2.2 Experimental animal and design

Twenty four (24) breeds, eight weeks old New Zealand rabbits were purchased from Animal breeding unit, Micheal Okpara University of Agriculture, Umudike, Abia state, with an average weight of 435-438g were used in the experiment. The rabbits were randomly assigned to four dietary treatments of T1, T2, T3 and T4 in a Completely Randomized Design (CRD) with six animals per treatment and two rabbits per replicate. The rabbits were weighed at the beginning of the experiment and thereafter weekly. They were individually housed in a wire merge cages measuring 50cm×35cm×40cm (width×length×height) and equipped with feeding and watering troughs. The cages were cleaned and disinfected before the arrival of the animals.

2.3 Preparation of test ingredients

Panicum maximum and *Gynura aurantiaca* leaf were harvested from the University of Port Harcourt premises and dried over night to reduce their moisture content before feeding separately to the rabbits. Thus, the ingredients used for the formulation of the conventional feed and proximate composition of *Panicum maximum* and purple velvet is shown in Table.1 and Table 2 respectively;

The treatment diets are as follow:

T1- Solely concentrates (C) at 100%

T2- equal mixture of concentrate at 50%+ 50% of *Panicum maximum* (C+G)

T3- equal mixture of concentrate at 50%+ 50% of *Gynura aurantiaca* (C+L)

T4- 50% of concentrate + 25% of *Panicum maximum* + 25% of *Gynura aurantiaca* (C+G+L)

TABLE 1
INGREDIENTS AND CHEMICAL COMPOSITION OF CONCENTRATE FEED

Ingredients	T1
Pkc	5.00
Maize	45.00
Maize offal	7.00
Wheat bran	4.50
Soya bean meal	16.00
Groundnut cake	11.00
Fish meal	4.75
Bone meal	3.00
Salt	0.25
Methionine	0.50
Lysine	0.50
Vitamin	2.50
Total	100

2.4 Experimental feeding management

The animals were group-fed *ad libtum* solely on conventional feed in the morning (08:00 hours) while the Panicum *maximum* and *Gynura aurantiaca* leaf meals were fed in the evening (05:00hours) among rabbits in T2, T3, and T4 throughout the duration of the research.

2.5 Proximate evaluation

Analysis for dry matter (DM) was determined by oven drying all samples at 105°C for 5 hours. Ash content was determined by igniting the dry samples in a muffle furnace at 550°C for 6 hours. Analyses for crude protein, crude fat, and ether extract were determined using methods described by AOAC (8). Also, the calculation for nitrogen free extract is: % NFE = 100 % – (% EE + % CP + % Ash + % CF).

2.6 Apparent nutrient digestibility

At the end of the feeding trial, fecal droppings were collected from each treatment and used for the digestibility trial for dry matter, crude protein, crude fibre, ash and NFE were calculated according to (8).

Thus, Apparent nutrient digestibility $= \frac{Quantity\ in\ feed - Quantity\ in\ feaces}{Quantity\ in\ feed} \times 100$

2.7 Cecal parameters

4 rabbits per treatment were randomly selected from the 4 dietary groups on the last day of the experiment, slaughtered, and samples of their cecal content were collected for cecal pH and NH_3.

2.8 Statistical Analysis

All the data generated were subjected to the analysis of variance (ANOVA) using SPSS (15) Statistical Software. Significant ($p<0.05$) differences were separated using Duncan New Multiple Range Test. The following model was used for the research

$$Y_{ij} = \mu + D_i + e_{ij}$$

Where: Y_{ij} = Individual observation,

μ= Overall mean,

D_i = Fixed effect of i^{th} diet effect

e_{ij} = Random error

III. RESULTS AND DISCUSSION

3.1 Proximate composition of *Gynura aurantiaca* and *Panicum maximum*

The results of the proximate composition of *Gynura aurantiaca* and *Panicum maximum* presented in Table 2. The Dry matter, crude protein, crude fat and crude fibre ranged from 94.64%-97.95%, 5.69%; 3.40% to 9.50%; and 19.20% to 57.01% respectively. The ash and nitrogen free extract ranged between 5.80% and 6.60%; and 26.05% to 53.62% respectively. The high dry matter content in *Gynura aurantiaca* and P*anicum maximum* can be attributed to rapid lignification's of carbohydrates with increase in age of the forage as affirmed by (9) and (10). The crude protein in *Panicum maximum* and *Gynura aurantiac* were within the range of crude protein of 8.75 to 18% reported for browse plant use in the experiment by (11) and (12) 5.00 - 35.00%. This showed that the test diet need could serve as a supplement to replace grain legumes in concentrate feeds or in low quality diets. The Crude fibre requirement for the rabbit from the current study was comparable to a value of 9.00 to 30.0% obtained by (12) and 9.0 to 37% reported by (13) which could be vital to enhance digestibility and decrease the blood cholesterol level. The value for crude fat for *Gynura aurantiaca* (3.40) and *Panicum maximum* (9.50) was comparable to the range of 1.5 to 12.00% reported by (11) which affirms that the test diet has the potential to provide rich source of carotene and pigment suitable in rabbit production.

TABLE 2
PROXIMATE COMPOSITION OF *GYNURA AURANTIACA* AND *PANICUM MAXIMUM*

Parameters	*Gynura aurantiaca*	*Panicum maximum*
Dry matter	97.95	94.64
Crude protein	5.69	5.69
Crude fat	3.40	9.50
Ash	5.80	6.60
Crude fibre	57.01	19.20
Nitrogen free extract	26.05	53.62

3.2 Apparent Nutrient digestibility of rabbit fed concentrate Guinea grass (*Panicum maximum*) and purple velvet forage (*Gynura aurantiaca*)

Table 3 shows the Apparent nutrient digestibility of rabbits fed concentrate, guinea grass, purple velvet forage. The result from the present study showed significant (P<0.05) difference on crude protein digestibility, dry matter digestibility, crude fat digestibility, ash digestibility, crude fibre digestibility, and nitrogen free extract digestibility. Thus, rabbits fed 50% concentrate+25% guinea grass+25% purple velvet showed superior values for crude protein digestibility, dry matter digestibility, and nitrogen free extract digestibility, with respect to other groups. Crude fat digestibility, and crude fibre digestibility were statistically highest among rabbits fed 50% concentrate+50% purple velvet when compared to other treated groups. Also, rabbits fed the control diet and those fed 50%concentrate + 50% purple velvet recorded similar values that were statistically highest when compared to others. The significant (P<0.05) difference obtained for nutrient digestibility in the current study corroborate with those reported by (14) fed concentrate, grass and legume combinations on performance and nutrient digestibility of grower rabbits under tropical conditions. Thus, the high digestibility of dry matter, and crude protein among rabbits fed 50% concentrate +25% guinea grass +25% purple velvet in this study indicates that the rabbits were able to utilize nutrients in the high forage and low concentrate combinations used for their growth. This was also buttressed from the works of (14) who stated that the combinations of concentrate, grass and forage would be adequate for grower rabbits. The superior value of crude fat digestibility among rabbits fed 50% concentrate + 50% purple velvet shows that the test diet has the potential to influence their metabolic functions positively as supported by (15). The notable improvement of crude fibre digestibility among the treated groups is an indication that rabbits used in this research efficiently utilized the fibre in the diet, which also opined the works of (16) that such forages were high in non-lignified materials. Furthermore, the Nitrogen free extract (NFE) digestibility was also better among rabbits in the control group and those fed 50% concentrate+25%guinea grass+25% purple velvet which could be attributed to high fibre content in the diet as there is considerable extraction of energy from the fibrous feeds that could satisfy their energy requirement.

TABLE 3
APPARENT NUTRIENT DIGESTIBILITY OF RABBIT FED CONCENTRATE GUINEA GRASS (*PANICUM MAXIMUM*) AND PURPLE VELVET FORAGE (*GYNURA AURANTIACA*)

Parameters	T1	T2	T3	T4	SEM
Crude protein digestibility	32.02^{c}	125.69^{b}	53.11^{c}	282.88^{a}	7.92
Dry matter digestibility	28.52^{d}	30.17^{c}	32.80^{b}	35.17^{a}	0.06
Crude fat digestibility	53.45^{b}	32.49^{c}	95.18^{a}	23.09^{d}	2.25
Ash digestibility	123.24^{a}	78.06^{c}	130.62^{a}	94.82^{b}	3.82
Crude fibre digestibility	68.38^{c}	140.22^{b}	229.58^{a}	141.51^{b}	22.02
NFE digestibility	80.40^{a}	66.10^{b}	51.91^{c}	81.82^{a}	3.29

[a,b]Means within each rows that are significantly (P<0.05) different among the treated groups.

3.3 Cecal parameters of rabbits fed concentrates Guinea grass (*Panicum maximum*) and purple velvet forage (*Gynura aurantiaca*)

The result of cecal nitrogen of rabbit fed concentrates Guinea grass (Panicum maximum) and purple velvet (*Gynura aurantiaca*) forage was shown in Table 4. Result from the current study showed that cecal pH and NH_3 were significantly ($P<0.05$) influenced by the test diet. Thus, cecal pH was statistically highest among rabbits fed 50% concentrate + 25% *Panicum maximum* + 25% purple velvet with decreasing levels of NH_3 with respect to other treatment combinations. Thus, the significant ($P<0.05$) difference on Cecal pH and NH_3 from the current study was in tandem with the works of (17) who affirmed similar results on cecal parameters of rabbits fed diets containing foliage and browse plants but disagree with the reports of (18) who reported that pH and ammonia values in rabbits did not differ significantly ($p>0.05$) among all treatments supplemented with forages. This significant increase in pH may be due to the glucosinolates content which represent an important class of organic compounds of sulfur and nitrogen in guinea grass and purple velvet which submit the digestion of gastrointestinal conditions as pH, temperature, enzyme and chemical conditions (19). However, the decline of NH_3-N with 50% concentrate + 25 % guinea grass + 25% purple velvet with increased levels of pH was consistent with those reported by (20) who recorded that the values of rumen pH and TVFAs concentration were increased, and the concentration of NH3-N was decreased with the increase of forage supplementation compared with the control lambs. This shows that Guinea grass (Panicum maximum) and purple velvet forage has the potential of absorbing ammonia for efficient use.

TABLE 4
CECAL PARAMETERS OF RABBITS FED CONCENTRATES GUINEA GRASS (*PANICUM MAXIMUM*) AND PURPLE VELVET FORAGE (*GYNURA AURANTIACA*)

Parameters	T1	T2	T3	T4	SEM
Cecal Ph	6.90^{b}	6.50^{c}	7.00^{b}	7.30^{a}	0.02
NH_3	4.30^{a}	4.00^{b}	3.80^{c}	3.60^{c}	0.01

^{a,b,}Means within each rows showing different superscript differ significantly ($P<0.05$)

IV. CONCLUSION AND APPLICATION

The result from the present study showed that

1. The experimental diet possesses adequate nutrient to support the well-being of the rabbits.
2. Guinea grass (Panicum maximum) and purple velvet (*Gynura aurantiaca*) forage recorded an improved dry matter digestibility, crude protein digestibility, crud fat digestibility, crude fibre digestibility, crude ash digestibility, and NFE digestibility.
3. 50% concentrate+25%guinea grass+25% purple velvet increased the cecal pH with decreasing levels of NH_3.
4. The research recommends that equal mixture of concentrate at 50%+ 25% Guinea grass +25% of Purple velvet in treatment 4 should be adopted due to their promising potentials from the parameters analyzed.

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