GROWTH RESPONSE OF WEANER PIGS FED ENZYME SUPPLEMENTED TIGER NUT (*Cyperus esculentus*) CHAFF BASED DIETS

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ABSTRACT
This study was carried out at the piggery unit of Alex Ekwueme Federal University Ndufu-Alike Ikwo, Abakaliki, Ebonyi State to evaluate the performance of weaner pigs fed graded levels of enzyme supplemented tiger nut chaff-based diets. Twenty-four commercial strain of large White weaner pigs with an average live weight of 7.52±0.18kg were used for the study. Sundried tiger nut chaff (waste from tiger nut processing) was collected from reputable tiger nut milk processors at Abakaliki, Ebonyi State, sun-dried for 5-7 days for the determination of proximate composition. Four (4) experimental diets were formulated such that tiger nut (Cyperus esculentus) chaff was included at 0%, 5%, 10% and 15% dietary levels coded (TNC_0) T1, (TNC_5)T_2, (TNC_{10})T_3 and (TNC_{15})T_4 respectively. Weaner pigs were randomly allocated to four (4) dietary treatments and were replicated three (3) times with each replicate having two pigs in a completely randomized design (CRD). The experiment lasted for 28 days (4 weeks). Results showed that pigs fed enzyme supplemented tiger nut chaff-based diets showed significantly ($P<0.05$) higher performance in terms of feed conversion ratio and cost benefit ratios than the control group. In view of the above results, enzyme-supplemented tiger nut chaff should be included in the ration of weaner pigs as a partial replacement for maize at 15% level for optimum performance and to boost animal protein consumption in Nigeria.
Key words: Weaner pigs, Growth response, Enzyme supplementation, Tiger nut chaff, Animal protein intake

INTRODUCTION

Swine production in Nigeria faces significant challenges, ranging from high feed cost, religious taboos and environmental degradation (Amole *et al*., 2022). These challenges adversely impact the quality and quantity of available animal protein for human consumption and invariably increasing the tool of malnutrition and infant mortality (Adhikari *et al*., 2022). To address these problems, it is crucial to explore the utilization of lesser-known unconventional feedstuff such as tiger nut (*Cyperus esculentus*) in swine feeding. Tiger nut (*Cyperus esculentus*) is an underutilized crop belonging to the Cyperaceae family, characterized by its rhizomes and somewhat spherical tubers (Yu *et al*., 2022) Tiger nuts are nutritionally valuable, providing high-quality oil (up to 25.5% content) and approximately 8% protein (Adhikari *et al*., 2022). They are also rich in dietary fibre, carbohydrates, and other essential minerals such as iron and calcium, which are vital for growth and development (Pelegrin *et al*., 2022; Yu *et al*., 2022). Additionally, tiger nuts contain phosphorus, potassium, sodium, magnesium, zinc, traces of copper, and vitamins E and C (Yu *et al*., 2022; Pelegrin *et al*., 2022).

Inclusion of alternative feed ingredients, such as tiger nut waste, in their diets holds promise as a sustainable solution to meet the growing demand for animal feed while reducing environmental waste (Olumide *et al*., 2020; Yu *et al*., 2022). Despite much work done in tiger nut, there is still dearth of information on the appropriate inclusion levels of tiger nut waste for optimum growth and productivity of weaner pigs hence, the relevance of this study.

MATERIALS AND METHODS

Location of the study

This study was conducted at the Piggery unit of the Teaching and Research farm of the Department of Agriculture, Alex Ekwueme Federal University Ndufu-Alike Ikwo, Ebonyi State which lies between latitude $06^0 15^{'}$N and longitude $08^0 5^{'}$E of the Greenwich meridian and Altitude of 55m. The annual rainfall is between 1000-1500mm. The vegetation of the area is predominantly derived Savannah and mean annual temperature is about 28^0C while relative humidity is between 50-60% (Climate-Data, 2023).

Experimental animals and design
Twenty-four commercial strain of large White weaner pigs with an average live weight of 7.52±0.18kg were used for the study. The pigs were placed in 0.3-0.5m² individual concrete floored pens fitted with feeding and watering troughs. Weaner pigs were randomly allocated to four (4) dietary treatments and were replicated three (3) times with each replicate having two (2) pigs in a completely randomized design (CRD). One-week equilibration period was observed before the commencement of the experiment. The routine management and prophylactic measures was observed accordingly. The experiment lasted for 28 days (4 weeks).

Collection and preparation of sample
The tiger nut chaff (TNC) was obtained from a reputable tiger nut milk processor at Abakaliki, Ebonyi State. After the collection, tiger nut were sun-dried for 5-7 days to reduce the moisture content and prevent the growth of molds on the treatment material.

Experimental diets and feed formulation
Four (4) experimental diets were formulated such that tiger nut (*Cyperus esculentus*) waste was included at 0%, 5%, 10% and 15% dietary levels coded (TNC_0) T_1, (TNC_5) T_2, (TNC_{10}) T_3 and (TNC_{15}) T_4 respectively. The control diet T_1 (TNC_0) did not contain any tiger nut chaff. The test ingredient was subjected to proximate analysis (AOAC. 2016). Table 1 shows the ingredient composition of the experimental weaner's diets.

Table 1: Ingredient composition of the experimental weaner's diets containing graded levels of enzyme-supplemented TNC based diets

Ingredients	TNC_0	TNC_5	TNC_{10}	TNC_{15}
Pure maize	50	47.50	45.00	42.50
Tiger nut Chaff (TNC)	0.00	2.50	5.00	7.50
Groundnut cake	20.00	20.00	20.00	20.00
Wheat offal	13.50	13.50	13.50	13.50
Palm kernel cake	7.00	7.00	7.00	7.00
Soya bean meal	3.00	3.00	3.00	3.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Vit/Min Premix	0.25	0.25	0.25	0.25
Enzyme	0.10	0.05	0.10	0.15
Total	100	100	100	100
Calculated composition				
Energy (Kcal/KgME)	2794	2768	2741	2715
Crude protein (%)	18.61	18.49	18.36	18.24
Crude fibre (%)	3.87	4.57	5.27	5.96
Ether extract (%)	3.99	4.06	3.15	4.21
Phosphorus (%)	0.63	0.49	0.58	0.60

Statistical Analysis
Data obtained from the study was subjected to the one-way analysis of variance (ANOVA) using general linear model of SPSS version (SPSS, 2017), while mean value variance showing ($P<0.05$) differences were separated using Duncan's Multiple Range Test as outlined by (Obi, 2002).

RESULTS AND DISCUSSION
The test ingredients (Table 2) revealed that it contains relatively low moisture content of 9.91% (Table 2). The low moisture content observed in TNC was in agreement with Olumide et al. (2020) who reported lower moisture content of below 10%. The relatively low moisture content of the tiger nut chaff (TNC) after sun drying will enhance good shelf life, relatively due to the low water activity as reported by (Frazier and Wstoff, 2010).
The proximate composition of tiger nut waste (Table 2) showed that it contains relatively low protein of 4.07% which implies that the TNC cannot be used as good source of protein in pig production. The value of protein obtained in this study aligns with the value of 4.40% obtained by (Olumide et al., 2020). However, Nkwocha et al. (2018) obtained higher values of 7.46% which might be attributed to the use of whole tiger nut meal and not the waste product. The high metabolisable energy of TNC based diets is attributed to high carbohydrate and crude fat content of the tiger nut chaff (Table 2). The crude fibre value of 30.23% obtained in this study was higher than 21.45% obtained by (Olumide et al., 2020) in a similar study on the evaluation of tiger nut (*Cyperus Esculentus*)

waste as feed ingredient in broiler chicken diet. However, Nkwocha et al. (2018), obtained crude fibre values of 25.33% which is lower than the value obtained in this study which

Table 1 Proximate analysis of dried tiger nut chaff

Parameters	Composition
Moisture content	9.91
Crude protein	4.07
Ether Extract	5.55
Ash	3.37
Crude Fibre	30.23
Carbohydrate (NFE)	47.98
Energy value (Kcal/Kg)	2571.43

appears to be attributable to the treatment of the tiger nut with bakery yeast to enhance digestibility and biotransformation of organic synthesis. According to Cherian (2020) the crude fibre of plant cell walls is a combination of the acid detergent fibre and neutral detergent fibre.

Table 3 shows the data on growth performance of experimental weaner pigs placed on enzyme supplemented tiger nut-based diets. From the data, the inclusion of tiger nut chaff and multi-enzyme (Growin Act) in the diet (Treatments 2-4) did not significantly affect weight gain compared to the control treatment (T_1). The final weights across all treatments were relatively similar, ranging from 13.18kg (TN_{10}) to 13.42kg (TN_0).

Pigs fed on enzyme supplemented tiger nut chaff-based diets showed significantly ($P<0.05$) higher performance in terms of feed conversion ratio and cost benefit ratios compared with the control group. The findings of the present study disagree with the report of Makkar et al. (2016) and Bello et al. (2020) that pigs receiving diets supplemented with tiger nut chaff exhibited improved weight gain compared to those on traditional feed. Tiger nut chaff and multi-enzyme supplementation did not significantly impact weight gain but improved feed efficiency. Treatment 3 (TNC_{10}) showed the best feed conversion ratio, indicating optimal utilization of nutrients.

Table 3: Growth performance of weaner pigs on enzyme-supplemented tiger nut chaff

Parameters	TNC_0	TNC_5	TNC_{10}	TNC_{15}	SEM	P-values
Initial live weight (kg)	7.70^{a}	7.46^{ab}	7.31^{b}	7.41^{ab}	0.072	0.141
Final body weight (kg)	13.42^{a}	13.40^{a}	13.18^{b}	13.39^{a}	0.057	0.141
Av. Total weight gain (kg)	5.72	5.46	5.87	5.98	0.052	0.049
Av. Daily weight gain (kg)	0.27	0.26	0.28	0.29	0.013	0.346
Av. Daily feed intake (kg)	0.47^{a}	0.42^{b}	0.41^{b}	0.44^{ab}	0.24	0.143
Feed conversation ratio	1.74^{a}	1.62^{b}	1.46^{c}	1.52^{b}	1.59	0.101
Cost/kg feed (₦)	651^{a}	646^{b}	618^{c}	607^{c}	8.16	0.026

^{abc}: Mean along the rows having different superscript of letters differed significantly at $P < 0.05$ level (LSD).
TNC= Tiger nut chaff

CONCLUSION AND APPLICATION

The results obtained from this study aptly demonstrated that Tiger nut chaff (TNC) has relatively good nutritional composition, thus making it fit for pig production at lower inclusion. The results shows that T_4 (15% inclusion) performed better than other levels of inclusion.

In view of the above results, enzyme-supplemented tiger nut chaff should be included in the ration of weaner pigs as a partial replacement for maize at 15% level for optimum performance and profit maximum so as to make animal protein available at a reduced cost.

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