

GROWTH PERFORMANCE AND ACCEPTABILITY OF PORK BUTT OF PIGS FED DIETS SUPPLEMENTED WITH *Nymphaea lotus* LEAF MEAL

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ABSTRACT

This study evaluated the growth performance and sensory attributes of pork butt from pigs fed *Nymphaea lotus* leaf meal (NLLM)-supplemented diets. Forty crossbred (Large White × Landrace) weaner pigs (7 weeks old; 9.41–9.82 kg) were randomly assigned to four dietary treatments in a completely randomised design, with five replicates of two pigs each. Treatments included 0% (T1/control), 0.5% (T2), 1% (T3), and 1.5% (T4) NLLM. Data collected included weight gain, feed intake, feed conversion ratio (FCR), and sensory evaluation of pork butt (aroma, flavour, tenderness, juiciness, and acceptability). All data collected were subjected to a one-way analysis of variance (ANOVA) using the statistical software package SAS (version 9.4). Significant differences among the means were determined at $p < 0.05$ using Duncan's Multiple Range Test. Average weight gain (AWG) was significantly ($p < 0.05$) influenced, with T1 (11.20 kg) and T2 (11.11 kg) showing higher gains than T3 (9.74 kg). Feed intake was unaffected ($p > 0.05$), while FCR varied significantly ($p < 0.05$), with T1 and T2 showing the best efficiency (2.10 and 2.09, respectively), while T3 recorded the highest FCR (2.39). Sensory evaluation showed no significant effects on aroma and flavour ($p > 0.05$), but tenderness (6.77), juiciness (6.45), and acceptability (6.66) were significantly higher in T2 ($p < 0.05$). These findings suggest that moderate inclusion of NLLM (0.5%) supports optimal growth performance, improves feed efficiency, and enhances pork quality, while excessive inclusion may negatively impact growth and meat attributes.

Keywords: Growth performance, Sensory attributes, *Nymphaea lotus* leaf meal, Acceptability, Water lily.

INTRODUCTION

Swine production plays a very important role in global food security by serving as one of the animal protein source entities. Protein is one of the major classes of food especially needed for bodybuilding, fighting against diseases, and improving immunity. Due to the significance, there is a high demand for animal protein in human diets in developing countries like Nigeria, especially for pork products (OECD and Food and Agriculture Organization of the United Nations, 2010). The increasing global demand for pork as a source of animal protein has intensified research efforts to enhance pig production efficiency while maintaining meat quality and economic viability. Consequently, plant-derived feed additives with functional properties have gained attention due to their potential benefits on animal health, growth-promoting effect, and enhancement of meat quality (Patra and Saxena, 2011).

In recent years, phytogetic feed additive substances have become progressively preferred alternatives for anti-microbial because of their capacity to promote growth (Ao *et al.*, 2011), and improve meat quality. The *Nymphaea lotus*, from the Nymphaeaceae family, frequently referred to as the Egyptian water lily is one of the potential plant feed additives which could be explored in monogastric nutrition. This aquatic plant is known for its rich phytochemical profile, including polyphenols, flavonoids, alkaloids, and essential minerals (Adebiyi *et al.*, 2024^a). These bioactive compounds have been associated with antioxidant, and growth-promoting properties when incorporated into animal diets (Ogbuwu *et al.*, 2019). Ethnomedicine studies have also recognized its antimicrobial properties against both gram-positive and gram-negative microbes (Akinjogunla *et al.*, 2009). Several studies have demonstrated that plant-based feed additives can improve nutrient utilization, modulate gut microbiota, and enhance meat quality in monogastric animals (Windisch *et al.*, 2008; Hashemi and Davoodi, 2011). However, limited research has evaluated the potential of *Nymphaea lotus* leaf meal (NLLM) in pig nutrition, particularly in terms of its effects on growth performance, and consumer acceptability of butt pork. This study aims to assess the effects of dietary supplementation with *Nymphaea lotus* leaf meal on the growth performance, and consumer acceptability of pork butt from pigs.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Piggery unit of Teaching and Research Farm, University of Ibadan, Ibadan, Oyo state, Nigeria.

Experimental Animals, Diets, and Management

A total of 40 crossbred (Large White × Landrace) weaner pigs of mixed sexes, aged seven weeks and weighing between 9.41 kg and 9.82 kg, were randomly assigned to four dietary treatments, with five replicates per treatment and two pigs per replicate. The pigs underwent a 7-day acclimatization period before the commencement of the experiment. The dietary treatments included T1 (control diet without *Nymphaea lotus* leaf meal (NLLM), T2 (basal diet + 0.5% NLLM), T3 (basal diet + 1% NLLM), and T4 (basal diet + 1.5% NLLM). The composition of the basal diet is shown in Table 1. The pigs had ad libitum access to feed and clean water throughout the six-week experimental period. The study was conducted in compliance with ethical guidelines, as approved by the University of Ibadan Animal Care and Use Research Ethics Committee (UI-ACUREC).

Data collection

Growth performance

Pigs were weighed biweekly using a digital hanging scale (OCS-X Crane scale) to monitor growth performance. Recorded parameters included initial body weight, total feed intake per week, and biweekly weight gain. Feed conversion ratio (FCR) and body weight gain were determined using the following formulas:

Total weight gain (kg) = Final weight – Initial weight

Feed intake (kg) = $\frac{\text{Total feed consumed per replicate}}{(\text{Number of days} \times \text{Number of pigs})}$

Feed conversion ratio (FCR) = $\frac{\text{Feed intake}}{\text{Weight gain}}$

Table 1: Gross Composition of Experimental Basal Diet

INGREDIENTS	QUANTITY (%)
Maize	50.1
Soya bean meal	28.25
Fish meal (72%)	1.5
Wheat offal	6.4
GNC	7
SoyaOil	2
Premix	0.25
Oyster shell	1
Bone Meal	2.5
DL- Methionine	0.25
L- Lysine	0.3
Table Salt	0.3
Toxin Binder	0.15
TOTAL	100
Calculated Nutrients (%)	
Crude protein (%)	22.54
ME (Kcal/kg)	2844.12
Crude Fibre (%)	4.14
Ether Extract (%)	4.1

*ME- Metabolizable energy;

Composition of vitamin premix per kg of diet; vitamin A,12,500,I.U; vitamin D 2,500I.U; vitamin E, 40mg, vitamin K3,2MG; vitamin B13,mg; vitamin B2 5.5mg; calcium panthothenate11.5mg; vitamin B6, 5mg; vitamin B12 0.025mg; choline chloride, 500mg; folic acid, 1mg; Biotin 0.08mg; manganese120mg; iron 100mg; zinc 80mg;copper, 0.8mg; iodine,1.5mg; cobalt, 0.3mg; selenium, 0.12mg; Anti-oxidant,120mg.

Sensory evaluation

A trained panel of 25 individuals (n=25) evaluated the sensory qualities of the pork butts using a nine-point hedonic scale. The assessed attributes included aroma, tenderness, flavour, juiciness, and overall acceptability. The scale ranged from 1 (poorest) to 9 (best).

Statistical analysis

All data collected were subjected to Analysis of Variance (ANOVA) using the General Linear Mode (GLM) Procedure of SAS, version 9.4 (SAS, 2015) and the significant means were compared with the control using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Growth performance

The growth performance of weaner pigs fed diets containing varying levels of *Nymphaea lotus* leaf meal is presented in Table 2. Average weight gain (AWG) was significantly ($P = 0.043$) affected by the dietary treatments, with pigs in T3 (9.74 kg) exhibiting lower weight gain compared to T1 (11.20 kg), T2 (11.11 kg), and T4 (10.36 kg). This suggests that higher inclusion levels of *Nymphaea lotus* leaf meal may have influenced

nutrient utilization, potentially due to anti-nutritional factors. However, feed intake (FI) did not differ significantly ($P = 0.296$) among treatments, indicating that the inclusion of *Nymphaea lotus* leaf meal did not influence feed palatability or voluntary feed consumption, which is consistent with previous findings that certain plant-based additives do not significantly alter feed intake in monogastric animals (Ogbuewu et al., 2019). In contrast, feed conversion ratio (FCR) was significantly influenced ($P = 0.0099$), with pigs in T3 showing the highest FCR (2.39), indicating poorer feed efficiency compared to T1 (2.10) and T2 (2.09). The relatively high FCR in T3 aligns with its lower weight gain, suggesting that excessive inclusion of *Nymphaea lotus* leaf meal may have led to reduced nutrient digestibility. This is in agreement with findings by Adebisi et al (2024)^b who reported higher FCR for pigs fed plant-based feed additives. likewise, Windisch et al. (2008), reported that excessive phytogetic feed additives could interfere with nutrient metabolism in monogastric animals.

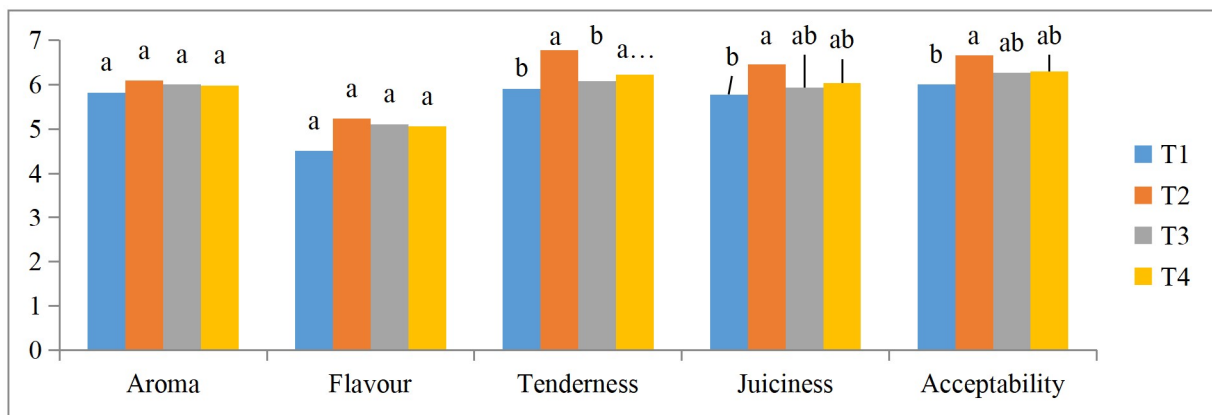
Table 2: Growth Performance of Weaner Pigs Fed Diets with Varying Levels of *Nymphaea lotus* Leaf Meal

Parameters	T1 (0% NLLM)	T2 (0.5% NLLM)	T3 (1% NLLM)	T4 (1.5% NLLM)	SEM	P-VALUE
Average Weight gain	11.20 ^a	11.11 ^a	9.74 ^b	10.36 ^{ab}	0.311	0.043
Feed intake	23.48	23.27	23.33	23.26	0.440	0.296
FCR	2.10 ^b	2.09 ^b	2.39 ^a	2.25 ^{ab}	0.01	0.0099

ab -Means in the same row with different superscripts differ significantly ($p < 0.05$)
NLLM- *Nymphaea lotus* Leaf Meal

Sensory Evaluation of Shoulder Cuts from Weaner Pigs Fed Diets Supplemented with Varying Levels of *Nymphaea lotus* Leaf Meal

The sensory evaluation of pork butt from weaner pigs fed diets containing varying levels of *Nymphaea lotus* leaf meal is presented in Figure 1. The results indicate that aroma and flavour were not significantly ($p > 0.05$) affected by dietary treatments, with scores ranging from 5.82 to 6.09 and 4.51 to 5.23, respectively. This suggests that the inclusion of *Nymphaea lotus* leaf meal did not impart any strong or undesirable sensory characteristics to the meat. The similarity in aroma and flavour scores aligns with previous findings that plant-based feed additives with phytochemicals do not necessarily alter meat sensory properties unless they contain distinct volatile compounds (Ogbuewu et al., 2019). These findings are consistent with the study by Omojola et al. (2009), who reported that plant-based feed additives did not significantly affect the aroma and flavour of pork. However, tenderness, juiciness, and overall acceptability were significantly affected by dietary treatments. Pigs in T2 exhibited the highest tenderness (6.77), which was significantly higher than T1 (5.90) and T3 (6.07), but similar to T4 (6.22). Similarly, T2 recorded the highest juiciness score (6.45), significantly ($p < 0.05$) higher than T1 (5.77), but not significantly different from T3 (5.93) and T4 (6.04). Juiciness and tenderness are often associated with moisture retention and fat content in meat, The increased tenderness and juiciness scores for T2 suggest that moderate inclusion of *Nymphaea lotus* may have influenced muscle structure, possibly by improving intramuscular fat deposition or moisture retention (Muchenje et al., 2009; Rossi et al., 2017). The improved tenderness in T2 may also be attributed to the antioxidant properties of *Nymphaea lotus*, which could reduce oxidative stress in muscle tissues, thereby enhancing meat quality (Hashemi & Davoodi, 2011). The acceptability scores in T2 (6.66), T3 (6.26) and T4 (6.30) were statistically similar. Though the acceptability score in T2 was significantly higher than T1 (6.00), the higher acceptability of meat recorded for T2 suggests that moderate inclusion of *Nymphaea lotus* leaf meal enhances meat quality attributes without negatively affecting sensory perception.



abc-Means with different superscripts differ significantly ($p < 0.05$)

Figure 1: Sensory evaluation of pork butt from weaner pigs fed diets supplemented with varying levels of *Nymphaea lotus* leaf meal

CONCLUSION

In conclusion, *Nymphaea lotus* leaf meal can be incorporated into weaner pig diets without negatively affecting feed intake, though high inclusion (>1%NLLM) may reduce feed efficiency. Moderate levels improved meat tenderness, juiciness, and overall acceptability, highlighting its potential to enhance pork quality. However, optimizing inclusion levels is essential, and further research on its nutrient utilization and long-term effects is recommended.

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