

## Growth performance, blood profiles and economic benefit of weaner pigs fed diets containing *ipomoea asarifolia* leaf meal

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### Abstract

The study was carried out to determine the growth performance, economic benefit and blood profile of weaner pigs fed diets containing *Ipomoea asarifolia* leaf meal. Forty-five weaner pigs of six months old with average weight of  $11.2 \pm 3.77$  kg were used in a 56 days feeding trial to evaluate the effects of dietary inclusion of *Ipomoea asarifolia* leaf meal (IALM) on the growth, haematology and serum biochemistry of weaner pigs. In a completely randomized design, the pigs were allotted to three treatment groups and further replicated three times with five pigs per replicate. The pigs were fed diets containing 0, 5 and 10% levels of IALM represented by treatments 1, 2 and 3, respectively. The study lasted for 56 days. Parameters monitored include growth performance characteristics and blood profile. Results showed that average daily feed intake, feed cost, cost of feed per kg weight gain were significantly different ( $p < 0.05$ ). Feed cost reduced from ₦169.22 in the control diet to ₦71.32 while the feed cost per kg weight gain reduced from ₦194.15 in the control to ₦104.88 in the treatment containing 10% IALM. Also, packed cell volume, red blood cell count, platelet count, aspartate transaminase, alanine transaminase, total bilirubin, total protein, globulin, urea, potassium, sodium and chloride values were significantly different ( $p < 0.05$ ). However, haemoglobin concentration, white blood cell count, neutrocytes, lymphocytes percentage and monocytes percentage values were not significantly different ( $P > 0.05$ ) between treatments means. Incorporation of *Ipomoea asarifolia* leaf meal in the diet of weaner pigs at 10% had no deleterious effect on the haematological and serum biochemical parameters.

**Keywords;** Blood; *Ipomoea asarifolia*; serum biochemistry; leaf meal; diets; weaner pigs

**Running title;** Effect of *Ipomoea asarifolia* leaf meal based diets on growth, economic benefit and blood profile of weaner pigs.

## Performances de Croissance, Paramètres Sanguins et Bénéfice Économique des Porcelets Sevrés Nourris avec des Aliments Contenant de la Farine de Feuilles d'*Ipomoea asarifolia*



### Résumé

L'étude a été menée pour déterminer les performances de croissance, le bénéfice économique et le profil sanguin des porcelets sevrés nourris avec des aliments contenant de la farine de feuilles d'*Ipomoea asarifolia*. Quarante-cinq porcelets sevrés de six mois avec un poids moyen de  $11,2 \pm 3,77$  kg ont été utilisés dans un essai d'alimentation de 56 jours pour évaluer les effets de l'inclusion alimentaire de farine de feuilles d'*Ipomoea asarifolia* (IALM) sur la croissance, l'hématologie et la biochimie sérique des porcelets sevrés. Dans un dispositif complètement aléatoire, les porcs ont été répartis en trois groupes de traitement et répliqués trois fois avec cinq porcs par répétition. Les porcs ont reçu des aliments contenant 0, 5 et 10 % d'IALM, représentés respectivement par les traitements 1, 2 et 3. L'étude a duré 56 jours. Les paramètres suivis comprenaient les caractéristiques de performance de croissance et le profil sanguin. Les résultats ont montré que la consommation alimentaire moyenne quotidienne, le coût de l'aliment et le coût de l'aliment par kg de gain de poids étaient significativement différents ( $p < 0,05$ ). Le coût de l'aliment est passé de ₦169,22 dans le régime témoin à ₦71,32, tandis que le coût de l'aliment par kg de gain de poids est passé de ₦194,15 dans le témoin à ₦104,88 dans le traitement contenant 10 % d'IALM. De plus, l'hématocrite, le nombre de globules rouges, le nombre de plaquettes, l'aspartate transaminase, l'alanine transaminase, la bilirubine totale, les protéines totales, la globuline, l'urée, le potassium, le sodium et le chlore étaient significativement différents ( $p < 0,05$ ). Cependant, la concentration en hémoglobine, le nombre de globules blancs, les pourcentages de neutrophiles, de lymphocytes et de monocytes n'étaient pas significativement différents ( $P > 0,05$ ).

entre les moyennes des traitements. L'incorporation de farine de feuilles d'*Ipomoea asarifolia* à 10 % dans l'aliment des porcelets sevrés n'a eu aucun effet délétère sur les paramètres hématologiques et biochimiques sériques.

**Mots-clés** : Sang ; *Ipomoea asarifolia* ; biochimie sérique ; farine de feuilles ; régimes alimentaires ; porcelets sevrés

### **Introduction**

Pig production is one of the fastest ways of increasing animal protein since pigs grow at a faster rate and are highly more prolific than cattle, sheep and goats (Ajala et al., 2017). Pig is considered as the animal with the fastest growth rate after chicken (Nwankwo et al., 2025). Therefore, a carefully planned feeding programme is important for a successful pig production. The fish and meat protein sources constitute about 6.0-8.44grams/capita protein consumption out of the 53.8g of meat per day that an average Nigerian consumes (Ogebe, 2020). The animal protein shortage in the diets of Nigerians and people from developing countries is now a matter of urgent concern and measures to save people from imminent protein malnutrition are imperative. It therefore becomes essential to increase animal production in order to meet the recommended daily protein intake. This is highly relevant to us in Nigeria who are very deficient in animal based diets. There are few standard commercial pig rations in the market and many pig farmers had depended on imported inputs such as parent and breeding stock, equipment, drugs and feed (Perez, 1997). Researchers in the area of Animal nutrition have been trying to test the efficacy and standardization of numerous potential feedstuff into viable conventional feedstuff that can be used for livestock production. One major problem that developing countries have been facing is their inability to develop local feed sources for economic growth and prosperity. Nwakpu *et al.* (1999), have reported that several potential feedstuffs like soyabean and maize which are also used for feeding pigs are expensive due to their direct competition with humans. Esonu *et al.* (2002) advised that livestock farmers should rather make use of cheap feed sources that are less expensive and suggested that leaf meals of various plant species should be used. This trial was designed to assess the effects of varying dietary inclusion levels of *Ipomoea asarifolia* leaf meal (IALM) with a crude protein level of 32%, metabolizable energy of 2760kcal/kg and

good mineral profile in the growth, haematological parameters and serum biochemistry of weaner pigs. This is with a view to reducing the dependence on conventional feed sources like maize, soyabean, palm kernel cake, sorghum etc, which are already so expensive as a result of yield reduction due to climate change and increased competition with humans due to population explosion.

### **Materials and methods**

#### ***Experimental location***

The experiment was carried out at the piggery farm of the Department of Animal science, Nnamdi Azikiwe University Awka, Nigeria.

#### ***Experimental animal***

A total of forty-five weaner pigs with average weight of  $11.2 \pm 3.77$ kg were used for this experiment which lasted for eight weeks. The experimental pens were thoroughly washed and cleaned before the selected weaner pigs were transferred into the pens. A total number of nine pens were used. The pigs were weighed before the experiment started and subsequent weights were taken on weekly basis. Five pigs were placed in each of the three replicates in the three treatments.

#### ***Experimental diets***

The experimental diets were made up of bambara chaff, brewers spent grain, palm kernel cake, salt and *Ipomoea asarifolia* leaf meal (IALM). The different treatment diets were T1 (0%IALM), T2 (5% IALM) and T3 (10% IALM). Specific amount of feed was offered to the animals daily while water was offered ad lib. The detailed composition of the experimental diets is shown in table 1.

**Table 1: Composition of Experimental Diets**

Ingredients	T1 (0%)	T2 (5%)	T3 (10%)
Bambara chaff	20.0	15.0	5.0
Spent grain	45.0	30.0	5.0
Palm kernel cake	34.0	49.0	79.0
IALM	0.0	5.0	10.0
Common salt	1.0	1.0	1.0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>
Crude protein (%)	19.08	19.27	19.47
Metabolizable Energy (kcal/kg)	2352.95	2319.60	2240.55
Crude fibre (%)	11.60	11.12	10.91

### Collection of blood samples

At the end of the 56 days, 27 pigs were randomly selected (three from each replicate) and blood collected through the veins under their stomach and analysed for haematology and serum biochemistry. About 5mL of blood sample was collected from each pig and transferred into an EDTA bottle and a plain container/tube for the determination of haematological analysis and serum biochemistry respectively. The following parameters were accessed; Packed cell volume (PCV), White blood cell count (WBC), Red blood cell count (RBC), Platelet count (PC), Haemoglobin concentration and Serum biochemistry were monitored. An Automatic Fully Digital Hematology Analyzer (Auto Hematology Analyzer, 3 Parts, HEMAD6031, Bioeopeak Ltd, China) was used for the determination of Haemoglobin, Hb (g/dl), Packed Cell Volume, PCV (%), red blood cell, RBC (X106 / $\mu$ l) and white blood cell, WBC (X103 / $\mu$ l). The Universal Clinical Auto Analyzer (Biochemistry Analyzer, BA-A-120, Boeopeak Ltd, China) was used for serum biochemistry determination. The haematological parameters; Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were estimated with the respective formulae presented below:

$$\text{MCV(fl)} = \text{PCV (\%)} / \text{RBC (x 106 / } \mu\text{l)} \times 10$$

$$\text{MCH(pg)} = \text{Hb(g/dl)} / \text{RBC (x 106 / } \mu\text{l)} \times 10$$

$$\text{MCHC(\%)} = \text{Hb(g/dl)} / \text{PCV (\%)} \times 100$$

### Experimental design and analysis

The study design was a Completely Randomised Design (CRD). The data collected was subjected to Analysis of variance (ANOVA) using SPSS analytical package and

differences between means were separated using Duncan's multiple range test (Duncan, 1955) at 5% probability level.

## Results and Discussion

### Growth performance of weaner pigs fed diets containing IALM

The growth performance of the pigs is presented in table 2. The analysis results showed that there were significant differences ( $p < 0.05$ ) in average daily feed intake, feed cost and feed cost per kg weight gain of the pigs fed diets containing *Ipomoea asarifolia* leaf meal. The average daily feed intake increased with an increase in the inclusion level of *Ipomoea asarifolia* leaf meal. This implies that the leaf meal improves feed intake in pigs. This may have been possible due to the palatable nature of the leaf meal. However, this does not agree with the report of Ekenyem (2006), who observed a decrease in daily feed intake of pigs as the inclusion level of *Ipomoea asarifolia* leaf meal increased. Also, feed cost also decreased as the inclusion level of *Ipomoea asarifolia* leaf meal increased which is in line with the report of Ekenyem (2006). This indicate that the diets formulated with the leaf meal were cheaper than the control diet and thus makes the use of *Ipomoea asarifolia* leaf meal in pig diet more economical thereby increasing the profit margin of pig production. The cost of feed that can add one kg of flesh also decreased as the inclusion level of *Ipomoea asarifolia* leaf meal increased. This implies that pig farmers can actually reduce their cost of producing one kg of pork by including *Ipomoea asarifolia* leaf meal in the diet of pigs.

**Table 2: Growth Performance of Weaner Pigs Fed Diets Containing *Ipomoea asarifolia* Leaf Meal**

Variable	Treatment 1	Treatment 2	Treatment 3	P value
Initial body weight (kg)	12.08±2.08	11.77±4.93	9.85±2.94	0.71
Final body weight (kg)	20.08±2.24	19.15±7.34	15.72±4.58	0.58
Total body weight (kg)	8.00±0.43	7.38±2.51	5.87±1.65	0.37
Average daily wt gain (kg)	0.14±0.01	0.13±0.04	0.10±0.03	0.35
Total feed intake (kg)	199.09±6.51	190.87±5.58	189.08±9.05	0.27
Average daily feed intake (kg)	35.54 <sup>b</sup> ±0.12	95.44 <sup>a</sup> ±2.79	94.54 <sup>a</sup> ±4.52	0.00
Feed conversion ratio	24.92±1.28	28.34±10.99	33.56±7.21	0.43
Feed cost (₦)	169.22 <sup>a</sup> ±5.54	129.75 <sup>b</sup> ±6.43	71.32 <sup>c</sup> ±3.46	0.00
Feed cost per kg weight gain (₦)	194.15 <sup>a</sup> ±6.01	158.09 <sup>b</sup> ±6.64	104.88 <sup>c</sup> ±4.45	0.00

means ±sd on the same row with different superscripts are significantly different ( $p < 0.05$ )

### Effects of including varying levels of IALM on the haematological parameters of weaner pigs

The haemoglobin concentration, white blood cell count, neutrocytes, lymphocytes percentage and monocytes percentage values were not significantly different ( $P > 0.05$ ) across treatments means as shown in (Table 3). However, significant differences ( $P < 0.05$ ) were found in packed cell volume, red blood cell count, and platelet count. Packed cell volume (PCV) had values within normal reference range for pigs (Etim, *et al.*, 2014) in treatments 2 and 3 but was lower in treatment 1 which had 0% IALM. Similarly, red blood cell count (RBC) values were higher under the 5%

level of IALM, but at 10% level of IALM, the value was slightly lower than that of 5%. This could be attributed to increased blood flow and normal oxygen carrying capacity of the pigs (Iyayi, 2001). Platelet counts were significantly higher in the 5% level of IALM, while at 10% level of inclusion, it was slightly lower than that of 5% IALM. This implies that the inclusion of IALM influenced the platelet count. It is also important to know that at 0% level of IALM, platelet counts were significantly low. The monocytes value fell within the normal range for pigs (Etim, *et al.*, 2014). Although, the results also showed that the inclusion of IALM at 5% and 10% increased the monocyte percentage value of the pigs.

**Table 3: Effects of Including Varying Levels of IALM on the Haematological Parameters of Weaner Pigs**

Variables	Treatment 1	Treatment 2	Treatment 3	P value
Haemoglobin (%)	9.80±0.82	11.46±0.45	12.13±2.02	0.15
Packed cell volume (%)	29.33 <sup>a</sup> ±2.08	34.83 <sup>b</sup> ±0.28	33.00 <sup>b</sup> ±1.00	0.01
Red blood cell ( $\times 10^{12}/L$ )	3.94 <sup>a</sup> ±0.22	4.91 <sup>b</sup> ±0.51	4.80 <sup>b</sup> ±0.33	0.03
White blood cell ( $\times 10^3/L$ )	16.53±2.45	26.03±8.79	19.36±4.40	0.21
Platelets count ( $\times 10^9/L$ )	32.00 <sup>a</sup> ±13.00	190.66 <sup>b</sup> ±58.82	165.33 <sup>b</sup> ±14.84	0.003
Neutrocytes (%)	9.30±6.22	8.76±0.35	10.70±2.33	0.82
Lymphocytes (%)	84.93±6.53	83.43±1.69	81.23±4.44	0.64
Monocytes (%)	5.76±0.91	8.80±0.10	8.06±2.30	0.09
Eosinophils (%)	Nil	Nil	Nil	0.00
Basophils (%)	Nil	Nil	Nil	0.00

means ±sd on the same row with different superscripts are significantly different ( $p < 0.05$ )

### Effects of varying levels of inclusion of IALM on the serum biochemistry of weaner pigs

Table 4 shows that the AST (aspartate transaminase), ALT (alanine transaminase), TB (total bilirubin), TP (total protein), GLB (globulin), urea, K (potassium), Na<sup>+</sup> (sodium)

and Cl<sup>-</sup> (chloride) values were significantly different ( $P < 0.05$ ) across treatments while the other serum biochemistry parameters were not significantly different ( $P > 0.05$ ). The results of the serum biochemistry generally shows that the values of the parameters were influenced by the inclusion of IALM.

**Table 4: Effects of Including Varying Levels of IALM on the Serum Biochemistry of Weaner Pigs**

Variables	Treatment 1	Treatment 2	Treatment 3	P value
AST (u/L)	51.66 <sup>a</sup> ±2.52	41.00 <sup>b</sup> ±1.00	33.00 <sup>c</sup> ±3.61	0.00
ALT (u/L)	75.33 <sup>a</sup> ±2.52	42.00 <sup>c</sup> ±4.00	58.66 <sup>b</sup> ±1.53	0.00
ALP (u/L)	182.00±7.94	159.00±2.00	167.33±24.58	0.24
TB (mg/dL)	0.06 <sup>b</sup> ±0.04	0.25 <sup>a</sup> ±0.05	0.20 <sup>ab</sup> ±0.10	0.04
CB (mg/dL)	0.01±0.01	0.03±0.06	0.06±0.05	0.35
UCB (mg/dL)	0.06±0.04	0.20±0.10	0.13±0.06	0.12
TP (g/L)	6.53 <sup>b</sup> ±0.15	7.00 <sup>a</sup> ±0.10	6.16 <sup>b</sup> ±0.32	0.01
ALB (g/L)	3.96±0.15	3.63±0.41	3.66±0.38	0.46
GLB(g/L)	2.56 <sup>b</sup> ±0.31	3.23 <sup>a</sup> ±0.25	2.23 <sup>b</sup> ±0.25	0.01
Urea (mg/dL)	48.66 <sup>ab</sup> ±8.02	38.33 <sup>b</sup> ±5.51	52.33 <sup>a</sup> ±4.62	0.08
CREAT (mg/dL)	0.86±0.25	0.90±0.20	0.73±0.23	0.66
K (mmol/L)	6.26 <sup>a</sup> ±0.32	5.40 <sup>b</sup> ±0.10	4.06 <sup>c</sup> ±0.60	0.00
Na <sup>+</sup> (mmol/L)	122.33 <sup>b</sup> ±4.51	141.33 <sup>a</sup> ±3.51	123.33 <sup>b</sup> ±3.78	0.00
Cl <sup>-</sup> (mmol/L)	101.33 <sup>a</sup> ±4.51	99.00 <sup>ab</sup> ±1.00	95.00 <sup>b</sup> ±2.00	0.09
HCO <sub>3</sub> <sup>-</sup> (mmol/L)	22.00±2.00	20.33±1.53	22.00±1.00	0.38

Means ±sd on the same row with different superscripts are significantly different (p<0.05)

Where; AST = aspartate transaminase, ALT = alanine transaminase, ALP = alkaline phosphatase, TB = total bilirubin, CB = direct or conjugated bilirubin, UC = un-conjugated bilirubin (which is deduced by TB – CB), TP = total protein, ALB = albumin, GLB = globulin, CREAT = creatinine, K = potassium, Na<sup>+</sup> = sodium, Cl<sup>-</sup> = chloride, HCO<sub>3</sub><sup>-</sup> = bicarbonate.

All serum electrolytes except creatinine and bicarbonate showed significant differences (p < 0.05) between the treatment means. The sodium electrolyte was within the normal reference range (Clark, *et al.*, 2009) at 5% IALM level and was significantly higher than that of 10% IALM level, but lower at 0% IALM level. Similarly, the potassium electrolyte fell within the normal reference range (Clark, *et al.*, 2009) at all levels of IALM. However, at 10% IALM level of inclusion the values were lower than that of 5% and 0% respectively. In essence, increased levels of IALM seemed to reduce the value of potassium electrolyte, although it was still within the normal reference range. The same results and observations in the potassium electrolyte were noticed in the chloride serum electrolyte, thereby confirming that the dietary inclusion of IALM at 5 and 10% did not negatively affect the serum electrolytes. Also, the total bilirubin (TB) values were within the standard reference range values and reference intervals for serum biochemistry and haematology on all levels of IALM, indicating that its inclusion was not undesirable for the pigs. The AST and GLB values were similarly within the standard reference range (Jain, 1993) on varying levels of IALM. The ALT values of pigs on 5% IALM level of inclusion was in the standard range values and reference intervals for serum biochemistry and haematology, but at 10% IALM it was a little higher, whereas at 0%

IALM it was significantly higher. This implies that the dietary inclusion of IALM reduced their ALT value which implies that 10% inclusion of IALM did not affect liver function. The total protein (TP) values for the different levels of IALM was higher than the standard reference range of 3.0 -4.9 (Jain, 1993), with the total protein value of pigs at 5% IALM inclusion level significantly higher than those at 10% and 0%. This could be a confirmation that the protein from IALM is of good quality. It can generally be observed that increased level of IALM enhanced the production of PCV, RBC and monocytes which were an indication of increased blood flow in the animals. Inclusion of IALM in the diet of pigs also reduced the levels of AST and ALT which indicated that IALM did not cause any liver necrosis in the animals.

#### Conclusion

In conclusion, *Ipomoea asarifolia* leaf meal has high potentials as a feed ingredient in pig production and could be included up to 10% without any harmful or undesirable effects on the haematological and serum biochemistry of weaner pigs and at a lower cost of production.

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