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Research Paper

Growth Performance and Cost Implications of Replacing Soyabean Meal with Graded Levels of African Yam Bean (*Sphenostylis Stenocarpa*) For Weaner Pigs

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I. Introduction

Pig production is one of the important livestock produced predominantly in the southern part of Nigeria. Many pig farmers rely on the use of wastes such as cassava peels, distillerywasteandkitchen waste to feed their pigs (FAO, 2009; Phengsavanh, Ogle, Stur, Frankow-Lindberg & Lindberg, 2010; Uddin &Osasogie, 2016) while a few uses formulated feed. Most ofthe formulated feed used in pig production in Nigeria are soybean based.Soybean (*Glycine max* (L.) Merrill) is a very rich source of high-quality protein with a crude protein content of about 36 to 44% and a crude fat content of 17 to 22% (Olomu, 2011). Soybean is utilized in many forms for human, livestock and industrial purposes among which include local delicacies such as soy-ogi, soy-garri, soy cheese, and soy milk (Omotayo, Olowe, Fabusoro, Babajide, Ojo&Adegbite 2007). Soybean meal (SBM), however, is the byproduct of the extraction of oil from soybean and it contains about 44 to 48.5% of crude protein and 1.10 to 1.50% crude fat (Olomu, 2011). Soybean meal is generally used in the formulation of livestock feeds especially for poultry, rabbits, cattle and pigs (Amusat&Ademola, 2013). The over dependence on soybean for livestock feed production as well as the competition with humans in consumption has led to shortages in its supply and necessitated the search for alternatives, especially in livestock feed production (Irekhore, Akinsoyinu, Babatunde& Bello, 2016) using abundantly available alternatives like theAfrican yam bean (AYB).

AYB(*Sphenostylisstenocarpa*) is a perennial leguminous plant which belongs to the family of Fabaceae (Heuzé& Tran, 2016). AYB is indigenous to Central and West Africa and it is grown for its edible tubers and seeds (Heuze& Tran, 2016). It is a nutritious plant with its seed having proximate nutrient composition of 26.88 - 28.36% crude protein, 1.78 - 2.48% ether extract, 3.95 - 5.30% crude fibre, 5.66 - 11.85% moisture content, 3.79 - 5.61% ash and 58.62 - 61.95% nitrogen free extract in the seed (Onuoha, Harry &Eze, 2017). Although AYB is very nutritious, it is one of the plants considered to be under-utilized (National Research Council, 2006; Oke, Sobowale&Ogunlakin, 2013), especially in feed formulation for animals like pig.

Pig Farmers are often faced with the challenge of inadequately ingredients for awell-balanced feed during formulation and high cost of bagged feeds as a result of shortages of soybean as the principal ingredient in the feed production (Ehirim, Okoro, Ikheloa, Nwauwa, Onwuagba&Mgbeojirikwe, 2017). These challenges push farmers to the use of agricultural byproducts and kitchen wastes in feeding their pigs. These feed sources are known to be unhealthy, imbalanced and exposes the pigs to diseases and results to slow growth rate for the pigs.The study explores the suitability of utilizing locally available substitutes such as AYBin feed production.

II. MATERIALS AND METHOD

The study was carried out in Nsukka, Nigeria. Nsukka has a tropical climate and is situated within the dry savannah zone with humidity ranging from 65 - 85%. The AYB used in this study weresourced from local market in Nsukka. The AYB were toasted for 30 minutes to reduce the moisture content. During toasting the beans were stirred thoroughly for homogeneous distribution of heat. The processed AYB were milled and used to replace soybean at 0%, 10%, 15% and 20% during pig feed formulation. The proximate composition of the diets was analyzedbased on AOAC (2010) suggested procedure (see Appendix A).

Sixty (60) weaner pigs were used for the study. After stocking, the weaner pigs were left to acclimatize for a period of one week, during which they were fed commercially formulated feed and dewormed using fenbendazole. The pigs were then randomly allocated to four groups and labeled T_1, T_2, T_3, and T_4. Each group were replicated thrice at five weaner pigs per replicate using a completely randomized design (CRD). The pigs were fed daily and water provided ad libitum for 16 weeks with formulated feeds – D1, D2, D3 and D4 (see Appendix B). Data were collected for feed intake, weight gain, linear body measurements and cost of feeding each group. Data on the linear body measurements were collected based on the body length, chest girth and height at the withers. The body length was measured weekly by obtaining the length of the weaner pigs from the base of the ear to the base of the tail. The chest girth was determined by obtaining the circumference of the chest region behind the forelegs while the height at the withers was measured by obtaining the distance from the ground to the shoulder when the animal was in a standing position. The prices of a unit of the feedstuffs multiplied by the quantity of each diet consumed per pig was applied in determining the cost of feed per piglet per group. Data on the carcass yield were determined by calculating the dressing percentage. The dressing percentage was calculated by dividing the carcass weight by the live weight of the animal before slaughter and multiplying by 100. The null hypothesis were tested with ANOVA at 0.05 level of significance and Duncan multiple range test was used in separating the means where significant difference exists. The data from the study were analyzed using SPSS version 21.

III. Result and Discussion

Table 1: Growth performance of weaner pigs fed with soyabean and graded levels of AYB.

Parameter	T1 (0%)	T2 (10%)	T3 (15%)	T4 (20%)	SEM
Initial body weight (kg)	7.00	7.33	8.17	7.10	0.216
Final body weight (kg)	20.50	18.00	19.00	21.83	0.710
Weight gain (kg)	13.50	10.67	10.83	14.73	0.684
Total feed intake (kg/pig)	98.23	98.27	98.23	98.27	0.691
Average daily feed intake (kg/pig/day)	1.56	1.56	1.56	1.56	0.003
Initial body length (cm)	49.33	50.67	49.67	50.00	0.429
Final body length (cm)	82.00	77.33	77.00	79.67	0.889
Body length gain (cm)	32.67	26.66	27.33	29.67	0.801
Initial chest girth (cm)	42.33	42.00	42.67	43.17	0.382
Final chest girth (cm)	61.50	59.63	57.10	60.30	0.736
Chest girth gain (cm)	19.17	17.50	14.43	17.13	0.662
Initial height (cm)	31.33	29.00	31.33	32.00	0.514
Final height (cm)	46.50	45.60	44.30	47.13	0.382
Height gain (cm)	15.17	16.60	12.97	15.13	0.687
Hot carcass weight (kg)	13.05	11.51	12.17	13.91	
Dressing percentage (%)	63.66	63.94	64.05	63.72	

The Table 1 shows data on the growth performance of weaner pigs with soyabean and graded levels of AYB. The data shows that the there was no significant difference ($P<0.05$) in the feed intake, weight gain, length gain, chest girth gain and height gain of weaner pigs fed with soybean and those fed with graded levels of AYB.

Table 2

Cost implications of substituting soybean with AYBin the diet of weaner pigs

Parameter	T1 (0%)	T2 (10%)	T3 (15%)	T4 (20%)	SEM
Cost per kg (₦)	150.30	154.52	156.63	158.64	
Total cost of feed consumed per pig (₦)	14,763.97[a]	15,184.68[b]	15,385.26[c]	15,589.55[d]	92.59
Cost of feed per kg weight gain (₦)	1,093.63[a]	1,423.12[c]	1,420.61[c]	1,058.35[b]	52.32

[abcd]Mean values in a row with different superscript are significantly different ($P<0.05$). SEM: Standard Error of mean

Table2 shows that there was significant difference ($P<0.05$) in the cost of substituting soybean with AYB in the diet of weaner pigs. The total cost of feed consumed per pig was significantly different from each other.

IV. Discussion

The result of the study revealed that the weaner pigs in all the treatments had similar feed intake which implies that AYB-formulated feeds had similar acceptance as soybean for weaner pigs. The weaner pigs fed with graded levels of AYB compared favourably with those fed with soybean in terms of weight gain. This finding is in line with that of weight gains likeOnyimonyi and Okeke (2007). The study showed that there was no statistical difference ($P<0.05$) in the weight gain of the weaner pigs in all the treatments although those fed with 20% AYB had the highest weight gain.Weaner pigs fed AYB also fared comparatively well in terms of body length gain, chest girth gain and height gain when compared to those fed with soybean. In terms of cost,

the weaner pigs fed AYB at 20% had significantly lower cost per weight gain. This finding in weight gain is in line with that of Onyimonyi in Obua, Okocha, EkereukeandMbenyi (2017).

The findings from this study confirmed that AYB can be a suitable alternative for soybean in feed formulation for pigs. AYB feeds of different composition seems acceptable and palatable for the pigs. Most importantly is the commendable growth performance among the pigs fed with AYB. AYB is abundantly available in rural communities in Africa, particularly in Nigeria. Its abundance means and cost implication means it can be considered for large scale cultivation and onward processing for animal feed production to replace soybean. This will reduce the dependence on soybean, reduce the stress on soybean production and free up soybean for human consumption and other important uses of soybean. However, further research is recommended to provide more robust information on the inclusion of AYB in animal feed production.

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Appendix A

Proximate composition of AYB

Parameter	Percentage composition (%)
Moisture	10.00
Crude fibre	39.53
Ether extract	7.00
Ash	4.95
Crude fibre	4.58
NFE	33.94

Appendix B

Percentage composition of the different formulated diets

Ingredients	D1 (0%)	D2 (10%)	D3 (15%)	D4 (20%)
Maize	67.30	67.30	67.30	67.30
Soyabean	29.25	19.25	14.25	9.25

AYB	0.00	10.00	15.00	20.00
Bone meal	2.00	2.00	2.00	2.00
Periwinkle shell	0.75	0.75	0.75	0.75
Common salt	0.50	0.50	0.50	0.50
Premix*	0.20	0.20	0.20	0.20
Total	100	100	100	100
Moisture (%)	11.00	10.00	6.00	8.00
Crude protein (%)	23.75	20.13	24.97	28.44
Ether extract (%)	4.00	3.00	3.00	6.00
Ash (%)	4.00	9.00	7.84	7.00
Crude fibre (%)	10.80	3.38	4.58	5.35
NFE (%)	46.45	54.49	53.61	45.21

*Premix contained: Vitamin A 12,000,000 IU; Vitamin D3 2,400,000; Vitamin E 35,000; Niacin 30,000mg; Vitamin K 4,000 mg; Vitamin B1 2,000 mg; Vitamin B2 7,000 mg; Vitamin B6 5,000 mg; Calcium pantothenate 10,000mg; folic 800mg; Vitamin B12 1,700mg; Biotin 2,000mg; Choline chloride 500,000mg; Copper 6,500mg; Iron 70,200mg; Zinc 85,500mg; Manganese 75,000mg; Iodine 400mg; Selenium 80mg; Cobalt 200mg; Antioxidant 1,250mg; Vitamin C 60,000mg per 2.5 kg.