Nigerian J. Anim. Sci. 2020 Vol 22 (2):140-146 (ISSN:1119-4308)

Evaluation of three commercially available pig starter feeds in South West Nigeria

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***Target Audience:** Pig farmer, Animal Scientist, Feed millers*

Abstract

The study evaluated the chemical composition of three available commercial starter feeds and their effect on performance of weaner pigs. Three samples of commercially available pig starter feeds in Southwest, Nigeria were evaluated using two different approaches (biological and chemical analyses). The three commercial feed samples in the study, were assigned to three dietary treatments, namely commercially available feed 1 (CAF1), commercially available feed 2 (CAF2) and commercially available feed 3 (CAF3). Forty-eight weaner pigs with an average initial body weight (BW) of 11.15±0.58 kg were randomly apportioned to the three treatments for biological (performance) evaluation of the three commercially available pig starter feeds. There were significant (P<0.05) differences among the performance indices across the treatments. Pigs fed with CAF1 and CAF2 had the highest (45.03 Kg) and lowest (26.04 g) values respectively for final body weight, even when the pigs fed with CAF2 and CAF3 had similar average daily feed intake (0.84 vs 1.0 Kg) while that of pigs fed CAF1 was significantly (P<0.05) higher (1.32 Kg). The feed with lower cost (CAF2) increased the feed cost per kilogram live weight gain of the animals by 10.93 and 13.70% when compared with that of feeds with higher cost (CAF1 and CAF3) respectively. Majorly, the ME (Kcal/Kg) and crude fibre contents of CAF2 were at variance with the nutrient requirements of weaner pigs, hence the inferior performance and economic results obtained with the diet. Even though, there were marginal variations in the nutrient compositions of the CAF1 and CAF3 feeds, their growth performance and economy of gain results were comparable because they fell within the recommended nutrient requirement for this class of pigs. In conclusion, only two of the three commercially available pig feeds (CAF1 and CAF3) sampled, could be said to have been formulated to meet the recommended nutrient requirement for this class of pigs, hence their comparable performance and economy of gain results.

***Keywords:** Commercial pig feeds, Weaner pigs, Biological evaluation, Chemical composition*

Description of Problem

Pig production has been seen as a remedy to protein inadequacy in Nigeria due to certain attributes possessed by pigs which are not exhibited by other domestic livestock. These attributes include their fast growth rate, prolificacy, good efficiency of feed utilization with consequent better returns per units of inputs and the quality of their meat, in terms of the contents of protein and the B vitamins (1 and 2). Despite these attributes, pig production has remained very low in Nigeria. Reasons for

slow growth of the swine industry include cultural beliefs, religion, acceptability and above all, management problems. The management problems include poor observance of biosecurity measures, disease outbreaks (of special importance is the reoccurrence of African swine fever), poor feed efficiency and high cost of feedstuffs such as maize and groundnut cake (1). Arising from this high cost of conventional feed stuffs, most farmers resort to sole feeding of their pigs with available agro-industrial by-products such as palm kernel cake, brewer wet/dried grain, wet/dried cassava peel and rice bran/husk, or a mixture of any two or three. This has further compounded the problem of poor productivity of pig industry in the country (3 and 4).

Recently, some feed industries have developed finished feed which are available commercially in the market for each of the phases of swine production. For pig farmers to rely on these commercially available feeds, the feed must meet the nutrient requirement of the particular phase of growth it is intended for. The information on the chemical composition of pig feeds can enhance the farmers' decision making, thus realizing the maximum production performance potential of the animals. Therefore, for a sustained and enhanced growth of the swine industry, the feeds given to the pig should be nutritionally balanced, as well as, good quality and health assuring, for their sustained supply and marketing (5). Many at times, the warranty level contained on the labels are not sufficient to ensure that the product provides good use of the nutritional principles and maximal expression of their production potential, since failures can occur thereby causing non-effective evaluation of the feeds (5). According to Conde *et al.* (6), the quality of a product is measured by its suitability for the intended use and this can be justified by lots of measures. The monitoring of the characteristics of products and processes can be implemented by means of many analytical tools, among which the physico-chemical methods stand out as both fast and conventional (7). Therefore, it was imperative to conduct experimental tests that assessed both chemically and biologically available commercial pig starter feeds. The result obtained would alert the manufacturers about the quality control of the products, as well as, constitute guidance to technicians and farmers. This would also help to avoid possible default in the feed formulations that could harm the health of the animals and consequently their performance **(**8). In addition, the target audience (farmers) who have been accustomed to the sole feeding of their pigs with available agro-industrial by-products such as palm kernel cake, brewer wet/dried grain, wet/dried cassava peel and rice bran/husk, or a mixture of any two or three will also know the quality of the feeds available in the market, thereby assisting them in their decision taking. Hence, the present study was conducted with the aim of carrying out biological evaluation and determining chemical composition of emerging pig starter feeds in Nigeria.

Materials and Methods

Experimental location and duration

The biological evaluation of the three commercially available feed was carried out at the AK Research Farms located at Eleyele, Ibadan, Oyo state, Nigeria (N 07.43093, E 003.84910). The study lasted for a period of 56 days.

Experimental feeds, animals and management

Three commercially available pig starter feeds (CAF1, CAF2 and CAF3) were sampled from the open market in Southwest Nigeria and evaluated using two different approaches (biological and chemical analyses). The

nutrients composition of the three commercially available pig starter feed according to their labels are shown in table 1. CAF1 contained 20.5 % crude protein (CP), 3359 Kcal ME/kg and 5.69% crude fibre. CAF2 contained 18.1% CP, 2543 Kcal ME/kg and 15.2% crude fibre while CAF3 contained 18.6 % CP, 2992 Kcal ME/kg and 7.07% crude fibre.

Biological evaluation

During the biological evaluation, the feeds (CAF1, CAF2 and CAF3) were fed to the experimental pigs**.** Forty-eight weaned pigs with average initial live weight of 11.15 ± 0.58 kg were randomly apportioned according to body weight and sex to the three treatments (CAF1, CAF2 and CAF3), with four replicates and four animals per replicate in a completely randomized design. The pigs were kept in pens (234 cm × 216 cm) which had concrete floors. Each pen had a concrete feeder (97 cm × 33 cm) and a concrete drinker (97 cm × 33 cm). All the pigs were fed with the experimental diets throughout the experimental period**.** The experimental diets and water were given to the animals *ad libitum* for the 56 day period of the experiment. Standard management practices were duly observed. The feed samples were analyzed for proximate composition using standard procedures (9). Data obtained were subjected to one-way analysis of variance and means were separated using Duncan Multiple Range Test.

Table 1. Nutrients composition on the label of each of the Feed

Parameters	CAF1	CAF2	CAF3
Dry Matter (%)	89.5	89.0	90.2
Crude protein (%)	20.5	18.1	18.6
ME (Kcal/kg)	3359	2543	2992
Crude fat (%)	5.03	10.0	7.73
Crude fibre (%)	5.69	15.2	7.07
Ash (%)	3.84	5.98	4.92
Calcium (%)	1.12	1.68	1.01
Phosphorus (%)	0.79	0.86	0.72
Methionine (%)	0.53	0.47	0.39
Lysine (%)	1.07	0.80	1.12
Lysine/Methionine (%)	0.76	0.75	0.90

Results and Discussion

The chemical analysis of the three commercially available pig starter feeds revealed the following nutrients composition as indicated in Table 2. The crude protein of CAF1 was the highest (17.2%) while that of CAF2 had the lowest crude protein (14.9%) and the highest crude fibre (6.53%) content. The crude protein of the three feeds differed significantly ($P<0.05$) from that recommended by (10) where 20% crude protein was reported to suffice for this class of pigs. Some of these values deviated from the values indicated in the label and values recommended (10) for starter pigs.

Table 2: Analysed chemical composition of diets

Parameters	CAF1	CAF2	CAF3
Dry matter (%)	90.7	90.3	90.7
Crude protein (%)	17.2	14.9	16.3
Crude fibre (%)	4.77	6.53	5.55
Crude fat (%)	3.82	3.62	3.74
Ash (%)	6.58	7.50	6.74
NFE (%)	58.3	57.8	58.3
NDF (%)	38.4	43.2	40.4
ADF (%)	17.6	21.5	19.2
ADL (%)	3.56	5.77	4.04
Hemicellulose (%)	20.9	21.7	21.1
Cellulose (%)	14.0	15.8	15.2
Gross energy(kcal/kg)	4240	4190	4230

NFE - Nitrogen Free Extract, NDF- Neutral Detergent Fibre, ADF- Acid Detergent Fibre, ADL- Acid Detergent Lignin, % - percent

Table 3 showed the performance of the weaner pigs fed with the experimental feeds at 0-4 weeks. Significant (P<0.05) differences were observed among the parameters measured for the performance evaluation during this period. Pigs fed with CAF1 and CAF3 showed superiority in terms of final body weight, body weight gain and daily weight gain over the pigs fed CAF2. The body weight gain (kg) ranged from 6.30 to 15.52, with the pig on CAF1 having the highest value, though comparable with that of pigs on CAF3. Pig on CAF2 had the lowest body weight gain (6.30 Kg). This pattern was also noticed in daily weight gain and daily feed intake across the treatments. Pigs with superior daily weight gain (CAF1 and CAF3) had higher daily feed intake. These animals (CAF1 and CAF3) had better feed conversion ratio compared to pigs on CAF2, with poorest feed conversion ratio (4.45).

Table 3: Performance of the weaner pigs fed the experimental feeds at 0-4 weeks

Parameters	**CAF1**	**CAF2**	**CAF3**	**SEM**	**P-value**
Initial body weight (Kg)	10.71	11.38	11.36	0.581	0.8703
Final body weight (Kg)	26.23^{a}	17.68^{b}	26.74^{a}	1.744	0.0461
Body weight gain (Kg)	15.52^{a}	6.30^{b}	15.38^{a}	1.363	0.0057
Daily weight gain (Kg)	0.45^{a}	0.18^{b}	0.44^{a}	0.038	0.0035
Daily feed intake (Kg)	1.11^{a}	0.70^{b}	0.97^{a}	0.043	<.0001
Feed conversion ratio	3.03^{b}	4.45^{a}	2.89^{b}	0.252	0.0208

ab Means with different superscripts across rows are significantly different (P<0.05), SEM; standard error of mean

The performance indices of the starter pigs fed the three commercially available pig starter feeds (CAF1, CAF2 and CAF3) at 0-8 weeks are presented in Table 4. There were significant (P<0.05) differences among final body weight, total weight gain, daily weight gain and average daily feed intake across the treatments. The final body weight (kg) ranged

from 26.04 to 45.03, with pigs fed with CAF1 and CAF2 having the highest and lowest values respectively. Both the body weight gain and daily weight gain followed similar pattern with that of final body weight. The pigs fed with CAF2 and CAF3 had similar average daily feed intake, while that of pigs fed CAF1 was significantly (P<0.05) higher. The pigs fed with CAF1 and CAF3 had the same feed conversion ratio, which was better than that of pigs fed CAF2. Inferences from the biological evaluation of these three commercially available pig starter feeds showed that CAF1 and CAF3 had similar and better performance. This implied that CAF1 and CAF3 could be considered suitable for the starter pigs, while CAF2 was considered unsuitable for this class of pigs.

Table 4. Performance of weaner pigs fed three commercially available feeds (0-8 weeks)

Parameters	CAF1	CAF2	CAF3	SEM	P-value
Initial body weight (Kg)	10.71	11.38	11.36	0.5814	0.8703
Final body weight (Kg)	45.03^{a}	26.04^{c}	38.46^{b}	1.6311	<0.0001
Total weight gain (Kg)	34.32^{a}	14.66^{c}	27.10^{b}	1.5718	<0.0001
Daily weight gain (Kg)	0.49^{a}	0.22^{c}	0.39^{b}	0.0218	<0.0001
Average daily feed intake (Kg)	1.320^{a}	0.84^{b}	1.00^{b}	0.0492	<0.0001
Feed conversion ratio	2.92^{b}	4.10^{a}	2.92^{b}	0.2023	0.0242

a*bc* Means with different superscripts across rows are significantly different (P<0.05), SEM; standard error of mean

The performance of the pigs fed with individual commercially available pig starter feed is a true reflection of nutritive value of the feeds. The poor performance of pigs fed CAF2 could be ascribed to the higher fibre and lower protein contents of the feed, when compared with both CAF1 and CAF3. High fibre diets had been reported to reduce the performance of growing pigs (11). The percentage of fibre (15.17 %) as indicated on the label was higher than the recommended value (10) for the weaner pigs (5 – 7 %) and the analyzed value (6.55%). Probably the feed had been fortified with enzyme envisaged to break the non-starch polysaccharides in the feed but could not break the nutrients encapsulated by the high fibre, thereby making them unavailable to the animals, thus resulting in low bioavailability of the nutrients. The quality of a product is its suitability for use to which it is intended (6) and this can be justified by lots of measures. The performance of the pigs fed CAF2 (T2) thus showed that the feed was not suitable for the weaner pigs, and this could be ascribed to the poor quality of the feed. Monitoring of the feed quality through biological and chemical evaluation is an important approach to validate the claimed potential of feeds by different manufacturers. This approach was similar to earlier report that physico-chemical methods stand out as both fast and conventional tools for analytical feed evaluation (7).

Economic analysis of weaned pigs fed three commercially available pig starter feeds

Significant (P < 0.05) differences existed in all the parameters used to measure the economics of production of pigs fed the three commercially available pig starter feeds, as shown in Table 5. The cost (₦) of producing a kilogram of each of the commercially available feeds ranged between ₦89.94 to ₦112.39. The CAF1 had the highest cost of producing a kilogram of the feed while the lowest cost was observed in CAF2. The total cost of feeding these three commercially available pig starter

feeds followed the same trend with that of feed cost per kilogram of the feed. The total cost of feeding ranged from ₦756.20 to ₦1483.65, with the higher value observed in CAF1 and the lowest value seen with pigs fed CAF2, which was highest in fibre. Production of feed with the cheapest cost should not be the ultimate goal while formulating animal feeds but, feeds that give optimum performance within a short period of time. This would translate to better performance in terms of economics of production. The cheapest of all these feeds (₦89.94/kg of feed) resulted in the highest cost of production (₦368.84) compared with the other feeds (CAF1 and CAF3), which had comparable values (₦328.52 and ₦318.32 respectively). The feed with lower cost (CAF2) increased the feed cost per kilogram live weight of the animals by 10.93 and 13.70% when compared with that of feeds with higher costs respectively (CAF1 and CAF3). This did not only increase the cost of producing a kilogram live weight of the animals but also resulted into waste of time and resources, due to the time that will be required to reach the final weights attained with the other two diets respectively. The feed cost/kg live weight of the pigs in this study was lower when compared to the earlier report by Adesehinwa *et al.* (12), where the cost of producing a kilogram live weight (₦/kg) of growing pig fed from different feeding troughs ranged from 380.09 to 407.34.

Table 5. Economic analysis of weaner pigs fed three commercially available feeds

Parameters	CAF1	CAF2	CAF3	SEM	P-value
Cost of feed/kg diet (₦)	112.39[a]	89.94[c]	108.96[b]	1.6635	<0.0001
Total cost of feeding (₦)	1483.65[a]	756.20[c]	1088.98 [b]	62.4444	<0.0001
Average cost of feed/ day (₦)	427.90[a]	305.55[b]	316.34[b]	21.9018	0.0334
Feed cost/Kg weight gain (₦/Kg)	328.52[b]	368.84[a]	318.32[b]	7.8324	0.0210

[abc] Means with different superscripts across rows are significantly different (P<0.05), SEM; standard error of mean

Conclusions and Applications

It could be concluded that

1. Chemical and biological evaluation should be done for emerging pig starter feeds before getting to the end users.
2. The study also revealed that there were marginal variations in the nutritional composition of the three commercially available pig starter feeds compared to what was displayed.
3. Two of these feeds met the nutritional requirements of this class of pigs, while the fibre content in the other was beyond what the starter pigs could tolerate, thus affecting the gut health negatively, hence poor performance of the animals.

Acknowledgements

The authors gratefully acknowledge the contributions and support received from Grand Cereals Limited, Jos and AK Research Farms, Ibadan for the execution of this study.

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