Growth performance of weaned pigs fed from different feeding troughs: comparison of concrete feeding trough, semi-automatic feeder and its combination

*Adesehinwa, A. O. K., Makanjuola, B. A. M., Ajayi E., Ogunyemi, D. J.¹, Boladuro, B. A., Abiola, J. O.² and Sorunke, A. O.

Institute of Agricultural Research and Training, Obafemi Awolowo University, Ibadan

¹Department of Animal Sciences, Obafemi Awolowo University, Ile-Ife

²Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.

*Corresponding author: aokadesehinwa@yahoo.com

Abstract

The study was carried out to evaluate the effect of concrete feeding trough, semi-automatic feeder and their combination on growth performance of weaned pigs. Sixty weaned cross bred (Large white x Landrace) pigs of average initial weight of 9.04 Kg were grouped based on sex and assigned to three dietary treatments, comprising two replicates of 10 weaned pigs each. The design of the experiment was completely randomized design. A standard diet was prepared to meet the nutrient requirements of weaned pigs. The diet was fed to the animals in concrete feeding trough (T1), semi-automatic feeder and concrete feeding trough (T2) and semi-automatic feeder (T3). The experiment was partitioned into three periods (Weeks 1-4, 5-8 and 1-8). Feed and water were given unrestrictedly throughout the period of the experiment. The feed intake and weights of the pigs were recorded on weekly basis. Feed conversion ratio and daily weight gain were calculated and the study lasted for eight weeks. There was no significant ($P>0.05$) effect of feeders on final body weight, average daily weight gain, daily feed intake and feed conversion ratio. The overall performance showed that combination of the feeders (T2) improved daily weight gain (369.71 g), average daily feed intake (1021.14 g) and had the best feed conversion ratio (2.99). It could be concluded that combination of concrete feeding trough and semi-automatic feeders improved the growth performance of weaned pigs.

Keywords: concrete feeding trough, semi-automatic feeder, growth performance, economic analysis

Introduction

The quest for strategies to reduce to some extent the body weight variability in pig industry has gained attention recently. The use of feeder space and feeding management are among those strategies (López-Vergé *et al.*, 2018). A possible way to minimize body weight variability depends on the feeder space and design. Feeders constitute a tool used for pigs to correctly access the diets (Gonyou and Lou, 2000) and acts as the interface to potentially meet their maximum growth. Feed intake is essential for a correct performance and limiting feed intake directly affects growth potential. Low feed intake in the post-weaning period and consequent low growth has been reported to impair performance and negatively affect metabolism and health

status in pigs (Dong and Pluske, 2007). Therefore, a right access to feed is crucial to allow pigs to meet their nutrient requirements or at least not to limit them (Gonyou and Lou, 2000). Several types of feeders for pigs have been identified in the market with an attempt to maximize feed intake, minimize feed waste in order to optimize pig performance.

Therefore, exploring different feeders may lead to differences in growth rate and variability. Thus, the objective of this study was to observe the effect of different feeders on the growth performance of weaned pigs.

Materials and methods

Experimental location and duration

The experiment was conducted at AK

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Research farms located at Eleyele, Ibadan, Oyo state, Nigeria and it lasted for a period of 56 days.

Experimental diet, animals and management

One experimental diet was formulated using the nutrient requirement recommendations for weaned pigs by National Research Council (1998) as a guide (Table 1). Sixty weaned pigs with average initial live weight of 9.04 kg were randomly allocated based on weight and sex to three experimental treatments (concrete feeding trough (97 cm L × 33 cm W) alone as T1 (Plate 1); Combination of concrete feeding trough and semi-automatic feeder as T2 (Plate 2) and semi-automatic feeder (56.0 cm L × 25.0 cm W) as T3 (Plate 3) with two replicates, ten

animals per replicate in a completely randomized design. The pigs were kept in Pens (234 cm L × 216 cm W) which had concrete floors with no litter. Each pen had a concrete feeder (97 cm L × 33 cm W) and a concrete drinker (97 cm L × 33 cm W). All the pigs were fed a common weaner feed contained 20.83 % crude protein and 2939.21 Kcal/ Kg metabolizable energy and 4.27% crude fibre. Animals were fed experimental diet with concrete feeding trough (T1), both concrete feeding trough and semi-automatic feeder (T2) and semi-automatic feeder (T3) for three periods (1-4, 5-8 and 1-8 weeks). The animals were allowed *ad libitum* access to the diets and water for the periods of the experiment. Standard management procedures were observed.

Plate 1: Concrete Feeding Trough

Plate 2: Combination of concrete feeding trough and Semi-Automatic Feeder

Plate 3: Semi-Automatic Feeder

Data collection

Animals were weighed on weekly basis and weekly feed offered and left over were monitored. At the end of the experiment, feed intake, weight gain and feed

conversion were evaluated. Samples of feed were analyzed for dry matter, crude protein ($N \times 6.25$), crude fiber and ash according to standard AOAC (2002) methods.

Table 1: Ingredient composition of the experimental diet

Ingredients	%
Ground nut cake	24
Palm kernel cake	7.34
Maize	45
Wheat offal	10
Lime stone	0.8
High quality cassava peel	5
Bone meal	1.6
Fish meal	3
Premix*	0.25
Salt	0.5
Methionine	0.03
Lysine	0.48
Palm oil	2
Total	100
Calculated analysis	
Crude fibre (%)	4.27
Crude protein (%)	20.83
Metabolizable energy (kcal/kg)	2939.21
Calcium	1.15
Phosphorus	0.60
Lysine	1.15
Methionine	0.34

*Premix supplied the following per kg diet: vitamin A 10,000,000 IU; vitamin D 32,000,000 IU; vitamin E 8,000 IU; vitamin K 2,000 mg; vitamin B1 2,000 mg; vitamin B2 5,500 mg; vitamin B6 1,200 mg; vitamin B12 12 mg; biotin 30 mg; folic acid 600 mg; niacin 10,000 mg; pantothenic acid 7,000 mg; choline chloride 500,000 mg; vitamin C 10,000 mg; iron 60,000 mg; Mn 80,000 mg; Cu 800 mg; Zn 50,000 mg; iodine 2,000 mg; cobalt 450 mg; selenium 100 mg; Mg 100,000 mg; anti-oxidant 6,000 mg.

Statistical and cost analysis

Data from the study were subjected to one-way analysis of variance (ANOVA) and significant means were separated using Duncan's Multiple Range Test using Statistical Analysis System (SAS) software for Windows (2003). Statistical significance was assessed at $P < 0.05$ (95% confidence interval). The cost per kg of the diet was calculated by multiplying the percentage composition of the feedstuffs with the prevailing price per kg of each

feedstuff and summing all. Total feed intake and cost per kg of feed was used to calculate the total feed cost. Feed cost per kg weight gain was calculated using the FCR and cost per kg of diet.

Results and discussion

Table 2 shows the analysed chemical composition of diet fed to weaned pigs. The crude protein and crude fibre are within the range recommended by National Research Council (1998).

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Table 2: Analysed chemical composition of weaner diets

Parameters (%)	Diet
Dry matter	90.56
Crude protein	18.78
Crude fibre	5.87
Crude fat	3.77
Ash	6.76
NFE	55.38
NDF	46.77
ADF	22.94
ADL	6.94
Hemicellulose	23.83
Cellulose	16.00
Gross energy	4.14(Kcal/g)

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

Growth performance of weaned pigs fed experimental diet with different feeders

The performance characteristics of weaned pigs fed a common diet using different feeders are presented in Table 3. There was no significant effect ($P>0.05$) of feeders on final weight (FW), daily weight gain (DWG), average daily feed intake and feed conversion ratio during the first phase (1-4 weeks). The daily weight gain ranged from 255.44 g to 319.36 g with the pigs fed in both semi-automatic feeder and concrete feeding trough (T2) having the highest daily weight gain. Pigs fed solely in semi-automatic feeder (T3) had the lowest daily weight gain. The combination of the feeders (T2) improved the daily weight gain by 14.2 and 20.0 % when compared with concrete feeding trough (T1) and semi-automatic feeder (T3), respectively, although, the improvement was not significantly different. The average daily feed intake ranged from 660.06 to 708.52 g. The pigs fed in both feeders (T2) consumed more feed than those fed in individual feeder. This implied that the pigs had more access to the feeds. Pigs fed with concrete feeding trough had the lowest feed intake. About 6.84 and 2.16 % increase in feed intake was observed in pigs fed in both feeders (T2) when compared with pigs fed in concrete feeding

trough and semi-automatic feeder respectively. The feed conversion ratios (FCR) of the pigs fed in the feeders individually or combined ranged from 2.50 to 3.19. Although, no significant difference exists among the feed conversion ratios but pigs fed in the combined feeders had the lowest and best FCR. The response of pigs to feeding in different feeders followed a similar pattern to the overall performance (1 – 8 weeks) during the second period of the experiment (5-8 weeks). The effect of different feeders on final weight, daily weight gain, average daily feed intake and feed conversion ratios was not significant ($P>0.05$) across the treatments. However, pigs fed with combined feeders had improved daily weight gain (369.71 g) and best feed conversion ratio (2.99) with highest feed intake (1021.14 g). The results showed a better performance in terms of final body weight and daily weight gain for pigs allocated to the combined semi-automatic feeder and concrete feeding trough across the periods. This is in agreement with the earlier results of He *et al.* (2016), the authors suggested that more feeder spaces to pigs could lead to a better feeding motivation with a consequent increase in performance. The better growth that was observed in pigs allocated to the

combined feeders (T2) probably explained by a higher feed intake and minimal feed wastage. The improved growth performance observed in pigs fed with the combined feeders (T2) reinforced the claims by several authors that feeders affect performance of pigs. According to Myers *et al.* (2013), wet-dry feeder improved the growth rate of finishing pigs and this also corroborates the earlier findings of Bergstrom *et al.* (2009) who reported improved growth performance in pigs fed with wet-dry feeders compared with pigs fed with conventional dry feeders. However, other studies have not shown significant differences in growth performance of pigs fed with different feeders. Again, Bergstrom *et al.* (2009)

reported no significant difference in feed intake, which is in line with the findings of this study. Patterson (1991) also did not identify any benefits in pig performance with wet-dry feeder design. The high feed intake observed in this study in pigs fed combined feeders supports the findings of Hurst *et al.* (2008) on higher feed intake for pigs fed with wet-dry feeder compared with those fed with conventional dry feeder. Lack of significant difference in all the parameters across the treatments and periods also supports the earlier findings of Brumm and Gonyou (2001) who reported no significant difference in growth performance but had improved performance in pigs fed with wet-dry feeders when compared with conventional dry feeders.

Table 3: Performance of weaned pigs fed experimental diet with different feeders

Parameters	T1	T2	T3	P (ANOVA)	SEM
Period 1 (1-4 weeks)					
Initial weight (kg)	8.73	8.64	9.75	0.17	0.30
Final weight (kg)	16.41	17.57	16.91	0.75	0.64
Daily weight gain (g)	274.08	319.36	255.44	0.24	17.75
Average daily feed intake (g)	660.06	708.52	693.23	0.68	22.74
Feed conversion ratio	2.63	2.50	3.19	0.16	0.16
Period 2 (5-8 weeks)					
Initial weight (kg)	16.41	17.57	16.91	0.75	0.62
Final weight (kg)	27.32	29.35	28.06	0.72	1.03
Daily weight gain (g)	389.80	420.07	398.30	0.71	15.32
Average daily feed intake (g)	1244.77	1333.76	1283.79	0.55	33.09
Feed conversion ratio	3.38	3.39	3.43	0.99	0.13
Period 3 (1-8 weeks)					
Initial weight (kg)	8.73	8.64	9.75	0.17	0.31
Final weight (kg)	27.32	29.35	28.06	0.72	1.03
Daily weight gain (g)	331.94	369.71	326.87	0.54	15.15
Average daily feed intake (g)	952.41	1021.14	988.51	0.61	27.86
Feed conversion ratio	3.06	2.99	3.30	0.60	0.13

SEM = Standard error of mean

Economic of production of weaned pigs fed experimental diet with different feeders

The economic analysis of weaned pigs fed same diet with different feeders is shown in Table 4. The cost of feed (₦/Kg) across the treatments for period 1 was the same because same diet was fed to all the treatments. Variations exist in total cost of

feeding (₦), average cost of feed per day (₦) and feed cost/Kg weight gain (₦/Kg), though these variations were not significantly ($P>0.05$) different across the treatments. The total cost of feeding varied from ₦2484.70 to ₦2667.10 with pigs fed in both feeders having the highest total cost of feeding. This inferred that the pigs fed in

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both feeders consumed more feeds than others. Similar pattern was observed in average cost of feed per day (₦) among the three treatments. However, pigs fed in both feeders (T2) had the lowest feed cost/kg weight gain (₦335.87/Kg). The highest feed cost/Kg weight gain was observed in pigs fed in semi-automatic feeder (T3).

Using semi-automatic feeder increased the feed cost/Kg weight gain by 17.55% when compared with concrete feeder. The economic analysis of pigs fed in different feeders during period 2 (5-8 weeks) and overall period of the study followed a similar trend with the economic analysis of the pigs during period 1 (1 – 4 weeks) of the study.

Table 4: Economic analysis of weaned pigs fed experimental diets with different feeders

Parameters	T1	T2	T3	P value	SEM
Period 1 (1-4 weeks)					
Cost of feed (₦/Kg)	134.40	134.40	134.40	--	-
Total cost of feeding (₦)	2484.70	2667.10	2609.60	0.68	85.59
Average cost of feed per day (₦)	88.74	95.25	93.20	0.68	3.06
Feed Cost/kg Weight Gain (₦/Kg)	353.04	335.87	428.20	0.16	20.92
Period 2 (5-8 weeks)					
Total cost of feeding (₦)	4685.70	5020.70	4832.60	0.55	124.57
Average cost of feed per day (₦)	167.35	179.31	172.59	0.55	4.45
Feed Cost/kg Weight Gain (₦/Kg)	454.58	455.13	461.16	0.99	17.07
Period 3 (1-8 weeks)					
Total cost of feeding (₦)	7170.4	7687.80	7442.2	0.61	209.79
Average cost of feed per day (₦)	128.04	137.28	132.90	0.61	3.75
Feed Cost/kg Weight Gain (₦/Kg)	411.05	401.99	444.14	0.60	17.71

SEM - Standard error of mean.

Conclusion

It could be concluded from the study that combination of concrete and semi-automatic feeding troughs improved the growth performance of weaned pigs better than the concrete feeding trough or the semi-automatic feeder alone.

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