ISSN 2714-4410
J. Anim. Prod. Res. (2019) 31(2):14-22

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GROWTH PERFORMANCE OF GROWING PIGS FED FROM DIFFERENT FEEDING TROUGHS

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ABSTRACT

Growth performance of growing pigs fed from concrete feeding trough, semi-automatic feeder and their combination was examined for eight weeks. Ninety-nine growing cross bred (Large white x Landrace) pigs of average initial live weight of 18.19±0.31 Kg were assigned to three dietary treatments, comprising three replicates of 11 growing pigs each in completely randomized design. A standard diet was fed to the animals in concrete feeding trough (T1; plate 1), concrete feeding trough and semi-automatic feeder (T2; plate 2) and semi-automatic feeder (T3; plate 3). Feed and water were given *ad lib* and weekly feed intake and weights were recorded. Feed conversion ratio and daily weight gain were calculated. The overall performance showed that combination of the feeders (T2) improved the daily weight gain (448.74 g) and average daily feed intake (1666.56 g). The pigs fed from both feeders (T2) had the highest ($P<0.05$) total cost of feeding (₦9293.40) while the lowest cost of feeding (₦8691.50) was observed in pigs fed from semi-automatic feeder (T3). In conclusion, the combination of concrete feeding trough and semi-automatic feeders improved the average daily weight gain and average daily feed intake of growing pigs when compared with the pigs fed from concrete feeding trough.

Key words: Concrete feeding trough, Semi-automatic feeder, Growth performance, Economic of production

INTRODUCTION

One of the challenges faced by pig farmers is lack of uniformity in body weight of the animals, even though the animals are subjected to the same dietary conditions. The search for strategies to address the issue of body weight variability among pigs of the same age has gained attention recently in pig industry. The use of strategies that are commercially relevant, easy to implement and acceptable, such as feeder space and feeding management are among those strategies (López-Vergé *et al.*, 2018). Feeder space and design has been considered to be one of the possible ways to reduce body weight variability experience in pig production. Feeder has been described as a tool used for pigs to correctly access the diets (Gonyou and Lou, 2000) and acts as the interface used for pigs to potentially meet their maximum growth. Feed intake is essential for correct performance and limiting feed intake directly affects growth potential. Low feed intake, which may be due to poor access to feed, 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 correct access to feed is fundamental to allow pigs to meet their nutrient requirements or at least not to limit them (Gonyou and Lou, 2000). Quite a number of feeders for pigs have been identified in the market, and all of them were designed for similar goals; to maximize feed intake and minimizing feed wastage in order to

optimize pig performance. The feeder, then, may affect the performance, growth and homogeneity of pigs (López-Vergé *et al.,* 2018). Therefore, using different feeders may lead to differences in growth rate and body weight variability in growing pigs. Thus, the growth performance of growing pigs fed from concrete feeding trough, semi-automatic feeder and their combination was studied.

MATERIALS AND METHODS

Experimental Location and duration

The experiment was conducted at AK farms located at Eleyele, Ibadan, Oyo state, Nigeria and it lasted for a period of 56 days.

Experimental Diet, Animals and Management

One single basal diet was formulated using the nutrient requirement recommendations for growing pigs by National Research Council (1998) as a guide (Table 1). The basal diet was in meal form, consisting of maize, high quality cassava peel, groundnut cake, palm kernel cake, rice bran, palm oil and a vitamin-mineral premix. The diet contained 19.72 % crude protein and 2921.84 Kcal/ Kg digestible energy and 6.28 % crude fibre. Ninety-nine growing pigs with average initial live weight of of 18.19±0.31 kg were randomly allocated based on weight and sex to three experimental treatments (concrete feeding trough (T1; Plate 1), concrete feeding trough and semi-automatic feeder (T2; Plate 2) and semi-automatic feeder (T3; Plate 3) with three replicates, eleven 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. All the pigs were fed a common grower feed**.** Animals were fed the experimental diet with concrete feeding trough (T1), both concrete feeding trough and semi-automatic feeder (T2) with feed equally divided and semi-automatic feeder (T3) for three periods (1-4, 5-8 and 1-8 weeks). Semi-automatic feeder used was a dry single-sided feeder with a guard that prevents wastage of feed by the animals and provided a total of 56.0 cm. × 25.0 cm (length × width) of trough space per feeder. The experimental diet and water were given to the animals unrestrictedly for the period of the experiment. Standard management practices were duly observed.

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 × 6.25), crude fiber and ash according to standard AOAC (2002) methods.

Table 1: Ingredient composition of the experimental diet

Ingredients	**%**
Maize	28.7
High quality cassava peel	10
Ground nut cake	25
Palm oil	3
Bone meal	1.4
Limestone	0.7
Palm kernel cake	20
Premix*	0.25
Rice bran	10
Salt	0.5
Lysine	0.45
Total	100
Calculated analysis	
Crude fibre (%)	6.28
Crude protein (%)	19.72
Metabolizable energy (kcal/kg)	2921.84
Calcium	0.89
Phosphorus	0.58
Lysine	1.01
Methionine	0.28

*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



Plate 1: *Concrete feeding trough*



Plate 2: *Concrete feeding trough and semi-automatic feeder*



Plate 3: *Semi-automatic feeder*

Data and cost Analyses

Data obtained from the study were subjected to one-way analysis of variance (ANOVA) using the General Linear Model procedures of SAS (2002). Statistical significance was assessed at $P < 0.05$ (95% confidence). 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 live weight gain was calculated using the FCR and cost per kg of diet.

RESULTS AND DISCUSSION

The analysed chemical composition of the experimental diet is shown in Table 2. The crude protein and crude fibre content of the diet were 18.68 and 5.72 % respectively. These values were similar to the calculated values and also in close range with those recommended by National Research Council (1998).

Table 2: Analysed chemical composition of the experimental diet

Parameters (%)	Diet
Dry matter	90.39
Crude Protein	18.68
Crude Fibre	5.72
Crude fat	3.97
Ash	6.81
NFE	55.22
NDF	46.79
ADF	23.00
ADL	7.02
Hemicellulose	23.80
Cellulose	15.98
Gross energy (kcal/g)	4.15

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

Growth performance of growing pigs fed from Different feeders

The growth performance of growing pigs fed from different feeders is shown in Table 3. No significant (P>0.05) effect of the feeders was observed at the end of the fourth week (period 1) of the experiment among the following parameters; final weight, average daily weight gain, average daily feed intake and feed conversion ratio. The final weight ranged from 30.16 to 30.35 Kg. The final weights were similar across the treatments. The values for average daily weight gain and average daily feed intake ranged from 426.61 to 437.39 g and 1315.18 to 1344.24 g respectively. The pigs fed from the combined feeders (T2) had the highest average daily weight gain (437.39 g) while the pigs fed from concrete feeding trough had the lowest average daily weight gain (426.61 g). There was a combined effect of the feeders, though not significant (P>0.05), on the average daily weight gain of the pigs with 2.5 % increase in daily weight gain when compared with pigs fed from concrete feeding trough. The feed conversion ratio ranged from 3.51 to 3.83. The performance results at the end of second period (5-8 weeks) of the experiment revealed similar pattern with that of first period (1-4 weeks) across the the treatments. The average daily weight gain ranged from 425.48 to 460.10 g. The highest average daily weight gain (460.10 g) was observed in pigs fed from the combined feeders (T2) while the lowest average daily weight gain (425.48 g) was obtained in pigs fed from semi-automatic feeder (T3). The use of the combined feeders (T2) improved the

daily weight gain by 2.3 and 7.5 % when compared with concrete feeding trough and semi-automatic feeder respectively. However, a significant ($P<0.05$) difference exists in average daily feed intake among the treatments with the values ranged from 1772.98 to 2004.40 g. The pigs fed from the combined feeders had the highest ($P<0.05$) feed intake (2004.40 g) while those fed from semi-automatic feeder had the lowest feed intake (1772.98 g). The combined feeders (T2) increased the feed intake by 8.1 and 11.5% when compared with concrete feeding trough (T1) and semi-automatic feeder (T3) respectively. The improved average daily weight gain revealed in pigs fed from combined feeders (T2) may be ascribed to the increase in average daily feed intake. It was observed that both the daily feed intake (1772.98 g) and daily weight gain (425.48 g) of pigs fed from semi-automatic feeder were the lowest among the treatments. This implied that, solely use of the semi-automatic feeder did not give the animal good access to the feed. This affects their intake and consequently their daily weight gain. Despite the significant ($P<0.05$) difference that was noticed in daily feed intake across the treatments, the feed conversion ratios were not significantly ($P>0.05$) different from one another. The values ranged from 4.23 to 4.53. The performance results of the third period (1-8 weeks) of the experiment followed the same trend with that of second period (5-8 weeks). No significant ($P>0.05$) difference was observed in all the performance parameters except average daily feed intake that was significant ($P<0.05$) different across the treatments. The average daily feed intake (1579.03 g) of pigs fed from concrete feeding trough (T1) and that (1558.61 g) of those fed from semi-automatic feeder (T3) were similar. However, the feed intake (1666.56 g) of the pigs fed from combined feeders (T2) was significantly ($P<0.05$) higher. Lack of significant difference in all the parameters across the treatments during the first period (1-4 weeks) of the experiment supports the earlier findings of Brumm and Gonyou (2001). The authors reported no significant difference in growth performance but with improved performance in pigs fed with wet-dry feeders when compared with conventional dry feeders. The improved daily weight gain observed in pigs fed from both feeders (T2) across the three periods may be ascribed to the better access to feed. This result agrees with the earlier findings of He *et al*. (2016), who reported that more feeder spaces to pigs could lead to a better feeding motivation with a consequent increase in performance. The better growth that was detected in pigs allocated to the combined feeders (T2) probably explained by a higher feed intake and minimal feed wastage. This is in line with the earlier findings of Bergstrom *et al.* (2015), who observed greater ($P<0.05$) daily weight and average daily feed intake in pigs fed using the wet-dry feeder had greater than those fed with the conventional dry feeder. The better performance in term of average daily weight gain of the pigs fed from combined feeder (T2) further strengthened the claims of 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 from wet-dry feeders compared with pigs fed from conventional dry feeders. However, other studies have not shown significant differences in growth performance of pigs fed with different feeders. Bergstrom *et al*. (2009) reported no significant difference in feed intake when pigs were fed from wet-dry feeders and conventional dry feeder. The findings of these authors disagreed with the result of present study in which pigs fed from combined feeders had the highest ($P>0.05$) daily feed intake compared with others fed from concrete feeding trough (T1) and semi-automatic feeder (T3). The higher feed intake may be as a result of correct access to the feed. The high feed intake observed in this study in pigs fed from

combined feeders supports the findings of Hurst *et al*. (2008) who reported significant difference in feed intake with pigs fed from wet-dry feeder having higher feed intake compared with those fed from conventional dry feeder.

Table 3: Growth Performance of growing pigs fed from Different Feeders

Parameters	T1	T2	T3	Pvalue	SEM
Period 1 (1-4 weeks)					
Initial weight (kg)	18.40	18.03	18.08	0.86	0.31
Final weight (kg)	30.35	30.28	30.16	0.99	0.64
Average daily weight gain (g)	426.61	437.39	431.67	0.97	17.74
Average daily feed intake (g)	1315.18	1328.71	1344.24	0.68	13.76
Feed conversion ratio	3.51	3.83	3.79	0.70	0.17
Period 2 (5-8 weeks)					
Initial weight (kg)	30.35	30.28	30.16	0.99	0.64
Final weight (kg)	42.93	43.16	42.07	0.86	0.81
Average daily weight gain (g)	449.55	460.10	425.48	0.27	8.54
Average daily feed intake (g)	1842.89^{b}	2004.40^{a}	1772.98^{c}	<0.01	15.98
Feed conversion ratio	4.23	4.53	4.43	0.53	0.11
Period 3 (1-8 weeks)					
Initial weight (kg)	18.40	18.03	18.08	0.86	0.31
Final weight (kg)	42.93	43.16	42.08	0.86	0.81
Average daily weight gain (g)	438.08	448.74	428.57	0.82	12.19
Average daily feed intake (g)	1579.03^{b}	1666.56^{a}	1558.61^{b}	0.01	14.04
Feed conversion ratio	3.83	4.09	4.03	0.67	0.13

SEM: Standard error of mean

Economic Analysis of Growing Pigs Fed from Different Feeders

Table 4 showed the economic analysis of growing pigs fed from different feeders. During the first period of the experiment (1-4 weeks), there was no significant (P>0.05) effect of feeders on the total cost of feeding (₦), average cost of feed per day (₦) and feed cost/Kg live weight gain (₦/Kg). However, the values for these parameters were increased numerically for the pigs fed from combined feeders (T2) and those fed solely from semi-automatic feeder (T3) compared with pigs fed from concrete feeding trough (T1). The values for total cost of feeding ranged from ₦3666.99 to ₦3748.01 with pigs fed from semi-automatic feeder and concrete feeding trough having the highest and lowest value respectively. The feed cost/Kg weight gain (₦/Kg) ranged from 349.78 to 381.72. The highest feed cost/Kg weight gain was observed in pigs fed from combined feeders (T2) while the lowest feed cost/Kg weight was noticed in pigs fed from concrete feeding trough. The use of combined feeders (T2) and semi-automatic

feeder (T3) increased the feed cost/kg live weight gain by 8.4 and 7.4 % respectively when compared with the concrete feeding trough (T1). This inferred that, for every one kilogram live weight of pig fed from combined feeders (T2) there was an increase of ₦31.94 in the cost of production when compared with the cost of a kilogram live weight of pig fed from concrete feeding trough. Similarly, the cost of producing a kilogram live weight of pigs fed from semi-automatic feeder (T3) was increased by ₦27.77 when compared with the cost of a kilogram live weight of pigs fed from concrete feeding trough. The economics of production at both second period (5-8 weeks) and third period (1-8 weeks) followed similar pattern. There was a significant ($P<0.05$) difference in the total cost of feeding (₦) among the treatments across the two periods. The values for total cost of feeding (₦) ranged from 4943.45 to 5588.69 and 8691.50 to 9293.40 for second period and third period respectively. The pigs fed from combined feeders (T2) had the highest ($P<0.05$) total cost of feeding while the lowest cost of feeding was observed in pigs fed from semi-automatic feeder (T3). The use of semi-automatic feeder individually or in combination seems not to be economical. This inference was drawn from the observation made on feed cost per kilogram live weight of pigs fed from combined feeders and semi-automatic feeder.

Table 4: Economic Analysis of Growing Pigs Fed from Different Feeders

Parameters	T1	T2	T3	Pvalue	SEM
Period 1 (1-4 weeks)					
Cost of feed (₦/Kg)	99.58	99.58	99.58	-	-
Total cost of feeding (₦)	3666.99	3704.73	3748.01	0.68	38.38
Average cost of feed per day (₦)	130.96	132.31	133.86	0.68	1.37
Feed Cost/kg live weight gain (₦/Kg)	349.78	381.72	377.55	0.70	17.37
Period 2 (5-8 weeks)					
Total cost of feeding (₦)	5138.36^{b}	5588.69 ^{a}	4943.45^{c}	<.001	44.55
Average cost of feed per day (₦)	183.51^{b}	199.60^{a}	176.55^{c}	<.001	1.59
Feed Cost/kg live weight gain (₦/Kg)	421.02	451.08	441.47	0.53	11.30
Period 3 (1-8 weeks)					
Total cost of feeding (₦)	8805.40^{b}	9293.40^{a}	8691.50^{b}	0.01	78.31
Average cost of feed per day (₦)	157.24^{b}	165.95^{a}	155.21^{b}	0.01	1.40
Feed Cost/kg live weight gain (₦/Kg)	380.89	407.34	401.71	0.68	13.17

SEM - Standard error of mean

CONCLUSION

It was concluded from the study that combination of concrete feeding trough and semi-automatic feeders improved the average daily weight gain and average daily feed intake of growing pigs compared with individual feeder. In addition, there was no significant effect of feeders on the cost of production of the growing pigs.

ACKNOWLEDGEMENT

The authors wish to acknowledge the contributions of AK Research Farms, for funding the research and paying the publication charges.

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