



GROWTH PATTERN AND BEHAVIOURAL RESPONSE OF WEANED PIGS TO MULTIPLE ENRICHMENT OBJECTS (POLYESTER ROPES)

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ABSTRACT

Pigs in an intensive production system usually exhibit adverse behaviour, which as a result requires the provision of enrichment objects. This study, therefore, was designed to determine the growth pattern and behavioural response of weaned pigs enriched with polyester rope (PR). Thirty-six pigs were allotted into four treatments (T) of three replicates in a completely randomized design. Pigs in control (T1) had no PR, while T2, T3 and T4 had one, two and three PRs, respectively. Behavioural observations were monitored with CCTV and recordings were made for 6 hours/day (09:00–12:00 and 15:00–18:00) in 3 days/week. At the end of the experiment, average feed intake and weight gain were determined, while the feed conversion ratio was calculated and the data were analysed using ANOVA. Behavioural observations: enrichment use (EU), pen-component manipulation (PCM) and pen-mate manipulation (PMM) were observed and analysed using repeated measures. Results revealed that polyester rope (irrespective of the number) had no significant effect ($P > 0.05$) on average feed intake and final weight. However, pigs in T2 (7.94 kg) had significantly lower average weight gain compared to the control group. Conversely, pigs in T4 (30.59 %) recorded higher value in EU compared with T2 (11.90 %) and T3 (23.59 %). Time of observation also had a significant effect ($P < 0.05$) with higher enrichment use of 23.86 % at 15:00–18:00 hours compared to 20.81 % at 09:00–12:00 hours. Experimental animals on polyester ropes (two and three), as used in this study, were comparable with the control group for body weight gain and feed conversion ratio.

Key words: animal welfare; behavioural response; environmental enrichment; pen manipulation; pig

INTRODUCTION

Production of pigs has been advocated as a short-term measure toward the alleviation of the animal protein deficit due to their fast growth rate. Pigs' prolificacy is another important factor contribution to its production and wide acceptance (Ogunniyi and Omoteso, 2011). Pigs had evolved in semi-woodland areas, where they had spent 75 % of their time in activities such as burrowing, foraging and exploring (CIWF, 2012). However, despite many generations of genetic selection, provision of feed, water and shelter in the modern pig production system, there is still an inherent

need for pigs to perform exploratory and foraging behaviours (Arey, 1993).

In modern housing, generally of concrete flooring and lack of rooting materials, the pig still has an intrinsic motivation to explore. However, this behavioural motivation is directed towards the pen-mates (Scott *et al.*, 2006a; Beattie *et al.*, 2000) and pen components (Scott *et al.*, 2007). These were the cause of adverse behaviours, such as tail biting, fighting, gnawing on the cage bars, nosing and ear-chewing in pigs (Scott *et al.*, 2006b). Vice behaviours exhibited by pigs may result in economic losses, which may discourage farmers whose main objective is to make profit.

Studies have suggested that environmental enrichment can enhance the welfare of growing pigs by providing materials for foraging, exploratory and manipulatory behaviour (Beattie *et al.*, 2000). The characteristics of objects, which were found to maintain a pig's attention, were ingestible, destructible, deformable, chewable and odorous (Van de Weerd *et al.*, 2003) and suggested that these might be best suited to satisfy exploratory and foraging motivations. However, the use of rooting materials, such as straw, in slatted systems can cause difficulties of management (Guy *et al.*, 2013) and it is, therefore, important to establish whether alternative forms of environmental enrichment, such as hanging objects, can be equally effective for slatted or concrete floors. Therefore, this study was performed to investigate the effect of different numbers of hung polyester rope on the growth pattern and behaviour of weaner pigs.

MATERIAL AND METHODS

This experiment was carried out at the Piggery Unit, Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. The 12 mm polyester ropes obtained from an open market in South-western Nigeria, were presented as environmental enrichment. The ropes were knotted at a specific interval, open-ended, and hung from the roof of the pen to the shoulders of the animals, which was regularly adjusted as the animals became bigger in size. A total of thirty-six (mixed sex of 2:1 female to male crossbreeds (Large White x Landrace) growing pigs of about 10 ± 0.15 kg were used. These animals were randomly allotted into four treatments. Each treatment had 3 replicates and each replicate contained 3 pigs. The design of the study has been completely randomised. The experimental layout was as the following:

Treatment (T1) = Control (without enrichment)

Treatment (T2) = One polyester rope per pen

Treatment (T3) = Two polyester ropes per pen

Treatment (T4) = Three polyester ropes per pen

Feed and water were provided twice a day at the hours of 08:00 and 14:00 daily. The animals

had access to feed and water *ad libitum*. The trial lasted for eight weeks. The feed intake and body weight of pigs were measured weekly using a weighing scale. At the end of the experiment, the total body weight gain was determined by subtracting initial body weight from the final body weight. Feed conversion ratio (FCR) was calculated from the obtained values for feed intake and body weight, as a ratio of feed intake and body weight.

Behavioural observations were monitored by the use of installed closed circuit television (CCTV) attached to each of the pens. Recordings were made for six hours a day and three days a week between the hours of 09:00–12:00 and 15:00–18:00. After the recordings, the behavioural parameters were counted from the recordings at one minute in ten minutes and recorded as a percentage of total observations.

Data collected included enrichment use (EU), general activities (GA), pen component manipulation (PCM) and pen-mate manipulation (PMM) according to the behavioural ethogram in Table 1. Behavioural data obtained from this experiment were analysed using repeated measures analysis of variance (ANOVA) procedure of SAS (2010). The performance data were analysed using a one-way ANOVA and time of the day with t-test. Significant means were compared using Duncan's multiple range test of the same package.

RESULTS

Table 2 shows the performance of grower pigs environmentally enriched with different numbers of polyester rope. Initial body weight, final body weight and feed intake were not different among the treatments. Average body weight gain was lower ($P < 0.05$) for pigs in T2 (7.9 kg) when compared with the animals in the control group (8.96 kg), but the values for animals in the control group, T3 and T4 were statistically similar. Feed conversion ratio was higher i.e. Feed conversion ratio was higher ($P < 0.05$) for pigs in T2 when compared with those in the control group. However, FCR for pigs in T3 and T4 was statistically similar to the rest of the treatments.

Table 1. Behavioural Ethogram

Category	Definition
Enrichment use	
Nosing substrate	Movement of snout along or close to substrate
Chewing Substrate	Substrate in mouth (with/without visible chew)
Rooting substrate	Displacing substrate with circular movements of the mouth/nose
Pen component manipulation	Nose or mouth in contact with pen sides or floor
Pen mate manipulation	
Nosing	Rubbing the body of pen mate with the snout, mostly directed to back, shoulders belly of flank and around the soft tissue between the limbs
Biting	Nibbling, sucking or chewing ears, legs, feet or tails
Rubbing	The resistance encountered when one pig is moved in contact with another pig (including mounting)
Chasing	The pursuit of one pig by another, the act of running and following a pig
General activity	
Feeding	Head in feeder or very close to feeder (includes nosing feeder)
Drinking	Mouth at drinker
Inactive	Standing or lying down and performing none of the above behaviours
Other	None of the above categories or impossible to assess what a pig is doing

Table 2. Performance of grower pigs environmentally enriched with different numbers of polyester rope

Parameters	T1	T2	T3	T4	SEM
Initial weight (kg)	10.31	10.39	10.23	10.25	0.12
Final weight (kg)	19.27	18.34	19.02	19.05	0.17
Average body weight gain (kg)	8.96 ^a	7.94 ^b	8.79 ^a	8.80 ^a	0.15
Average feed intake (kg)	29.88	28.66	30.95	29.93	0.43
Feed conversion ratio	3.36 ^b	3.62 ^a	3.52 ^{ab}	3.40 ^{ab}	0.44

^{a, b} Means with different superscripts in the same row differ significantly $P < 0.05$; SEM = Standard error of mean.

T1 = control, T2 = one rope per pen, T3 = two ropes per pen, T4 = three ropes per pen.

The behavioural response of pigs to a different number of ropes, used as environmental enrichment of the experimental animals, is shown in Table 3. Pen-mate manipulation, pen manipulation and general activities were lower ($P < 0.05$) for animals of all the treatments when compared with the control group. The higher the number of rope were used, the lower the pen-mate, manipulation, pen manipulation and general activities were observed. On the contrary, the higher the number of rope were used, the higher the values were obtained for enrichment use.

The result of behavioural response of pigs to time of the day, when the polyester rope is used as environmental enrichment, is shown in Table 4. At 09:00–12:00 hours, the pen-mate manipulation (22.20), pen manipulation (27.76) and general activities (29.23) were significantly higher ($P < 0.05$) when compared with the pen-mate manipulation (21.65), pen manipulation (26.16) and general activities (28.33) at 15:00–18:00 hours. Conversely, the enrichment use at 15:00–18:00 (23.86) was higher than at 09:00–12:00 (20.81).

Table 3. Behavioural response of pigs to different number of rope used as environmental enrichment

Percentage observation	T1	T2	T3	T4	SEM
Pen-mate manipulation	28.93 ^a	25.23 ^b	21.58 ^c	18.22 ^d	0.84
Pen manipulation	41.13 ^a	33.29 ^b	26.42 ^c	23.43 ^d	1.16
General activities	29.94 ^a	29.58 ^b	28.40 ^c	27.76 ^d	0.65
Enrichment use	0.00 ^d	11.90 ^c	23.59 ^b	30.59 ^a	1.92

^{a, b, c, d} Means with different superscripts in the same row differ significantly $P < 0.05$; SEM = Standard error of mean.

T1 = control, T2 = one rope per pen, T3 = two ropes per pen, T4 = three ropes per pen.

Table 4. Behavioural response of pigs to time when rope was used as environmental enrichment

Percentage observations	09:00–12:00	15:00–18:00	SEM
Pen-mate manipulation	22.20 ^a	21.65 ^b	0.45
Pen manipulation	27.76 ^a	26.16 ^b	0.51
General activities	29.23 ^a	28.33 ^b	0.43
Enrichment use	20.81 ^b	23.86 ^a	0.69

^{a, b} Means with different superscripts in the same row differ significantly $P < 0.05$; SEM = Standard error of mean.

DISCUSSION

The results obtained in the present study revealed that provision of enrichment using two and three ropes were comparable with the values obtained for the control, which could point to a positive influence on growth performance of the experimental group.

Nannoni (2019) reported that environmental enrichments did not improve the productivity of pigs. Peeters *et al.* (2006) also observed that ADFI and FCR were similar in all treatments. However, Van de Weerd *et al.* (2006) reached an improvement in the performance of pigs when different enrichment objects were provided. Similarly, Gracner *et al.* (2013) observed that pigs in enriched environments had higher growth rates, which was attributed to higher average daily feed intake. The variability in the results of the previous studies may be due to the differences in the enrichment objects used.

The findings of this study suggested that providing animals with an adequate amount of enrichment would divert their attention from performing adverse behaviour towards the pen mate and pen components. Exploratory behaviour

of pigs in barren environment of piggery with inadequate objects is redirected towards pen-mates and pen components (Guy *et al.*, 2002). It has been suggested that pigs in enriched piggery have more opportunity to flee from a fight or to avoid other pigs (Beatie *et al.*, 2000). It could be stated that provision of polyester rope in hanging form elicits appropriate stimuli that give the pigs control over their environment by concentrating on the objects provided (Telkanranta *et al.*, 2014), thereby, reducing adverse behaviours like belly nosing, rubbing, chasing and fighting, which are normally the causes of injuries in swine production. Similarly, at the long-run, the cost of repairing or re-construction of pen-components may be reduced, as the attentions of the animals have been shifted to enrichment provided.

At 09:00–12:00, increased behavioural activities like chasing, biting and fighting were noticed, as well as increased activities at the feeders and drinkers, thereby increasing pigs' interaction with the floor, wall and gate of the barn. This consequently led to an increase in pen-mate manipulation, pen manipulation and general activities observed at this time. However, the reduction in the pen-mate

manipulation, pen component manipulation at the 15:00–18:00 hours might have been due to the increased enrichment use at these hours and the less interaction with enrichment objects at 09:00–12:00. This confirms the reports of Guy *et al.* (2002) and Beattie *et al.* (2000) that increased use of enrichment devices led to the reduction in pen component interaction and pen-mate manipulation. It was also documented that period of the day influences enrichment use (Trickett *et al.*, 2009).

CONCLUSION

Findings of this study indicate that the provision of hung polyester rope (two or three ropes per pen) is an important instrument in diverting pigs' attention from the pen-mate and pen component. Furthermore, the more the number of enrichment (rope) the better the growth performance response.

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