

Enrichment strategy of object combination on the behaviour of growing pigs

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Abstract

This study was carried out to determine the effect of object combination as environmental enrichment on behaviour of growing pigs. Thirty-six (36) crossbreed (Large White X Landrace) growing pigs with average weight of 34-36Kg were allotted randomly into four treatments, replicated three times in a completely randomized design. The four treatments were; Control (without enrichment), PRope (2 pieces of polyester rope), treatment SWood (2 pieces of soft wood) and treatment PRope+SWood (1 piece of soft wood and 1 piece of polyester rope). Behavioural observations were monitored by CCTV and recordings were made for 6 hours/day and 3days/week. At the end of the experiment, data collected includes average feed intake and average weight gain while feed conversion ratio was calculated. Likewise, behavioural observations; enrichment use, general activities, pen manipulation and pen-mate manipulation were observed. Behavioural data were analyzed using repeated measures analysis of variance (ANOVA) while performance data were analysed using one-way ANOVA. Performance data were significantly influenced ($P<0.05$) by enrichments for all the parameters measured. PRope+SWood had the highest value for the final weight (50.63kg), average weight gain (15.95kg) and average feed intake (56.61kg) while PRope had the highest FCR 4.18). Penmate manipulation (10.48%), pen manipulation (19.02%) and general activities (14.62%) were lower and significantly better for PRope+SWood compared to PRope and SWood and the highest interaction with enrichment objects was observed in the PRope+SWood (55.88%). It can be concluded that the use of combination of enrichment objects enhanced the performance and behaviour of pigs.

Keywords: Behaviour, Environmental enrichment, Enrichment use, Pen-mate manipulation, Pen manipulation

Introduction

It has been predicted that around 200 million tonnes of meat would need to be produced annually by 2050 (Bruinsma, 2009) to meet the increase in human population. Therefore, it was projected that global consumption of pork will amount to around 127.52 metric kilotons only by 2026 (Statista 2018), which will only be slightly surpassed by the best, carefully managed poultry and beef. The production of pigs has therefore been advocated as a short term measure towards alleviation of the animal protein deficit. Pigs have evolved in semi-woodland areas, where it had spent 75% of their time in activities such as burrowing, foraging and exploring (CIWF, 2012).

Despite many generations of genetic selection, provision of feed, water and shelter in modern pig production system, there are still inherent need for pigs to perform exploratory and foraging behaviours (Arey, 1993). Generally, the behavioural repertoire of animals is altered by captivity (Garner, 2005), leading to the development of abnormal behaviours due to frustration (Broom, 1998). For instance, ear biting which induces stress in pigs, serves as strategy to cope with the repression of their natural behaviours (Van de Weerd *et al.*, 2009). Giving animals the enabling opportunity to exhibit their natural species specific deportment has been known to improve welfare by reducing

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stress levels (Novak and Suomi, 1988). This over the last few years increasingly has become a subject of concern, which invariably is a significant pillar in ensuring the survivability of the swine industry (Velarde *et al.*, 2015). Negative impacts of barren pens can be reduced by providing enrichment objects to the pigs. A recent meta-analysis on enrichment benefits indicated that enrichment led to a 50% reduction of abnormal behaviour in a range of captive animals, however, pigs' interest in the objects is likely to be influenced by the type of material and positioning within the pen (Van de Weerdet *et al.*, 2003). Chewable and destructible materials, such as wood and rubber are more likely to sustain interest and are more likely to reduce injurious social behaviours between pigs compared to harder materials like metal chains (Bracke *et al.*, 2006). On the other hand, objects that are suspended at shoulder level to the pigs in the pen could initiate more manipulation since they are more visible and they stay cleaner than objects on the floor (Averos *et al.*, 2010). However, interest in an object can decrease after a few days or a few weeks or can lose some of their attractiveness after a while (Telkänranta *et al.*, 2014). In order to avert the rapid habituation to a certain object, it is therefore essential to know if combination of objects can reduce the rate of loss of interest in a particular object. Therefore, this study was carried out to check the effect of combination of two enrichment objects on the behaviour of growing pigs.

Materials and methods

This experiment was carried out at the Piggery unit of Teaching and Research Farm, University of Ibadan, Ibadan, Oyo State, Nigeria. Thirty-six (36) crossbreed (Large White X Landrace) growing pigs of about 34-36Kg were used for this study. The animals were allotted randomly into

four treatments replicated three times (n=3) in a completely randomized design (CRD). Feed and water was provided twice daily during the eight weeks period of the experiment.

Two types of objects were used as enrichment; polyester rope and soft wood. The rope used was 14mm, blue, open ended and knotted at interval, while the wood was 55 x 5.0 x 4.5cm and suspended on each side by 6mm blue rope. These objects were suspended from the roof to the shoulder length of the animals. The objects were replaced every two weeks or as at when eaten or broken by the animals, the length was also adjusted as the animals grow. The four treatments were; treatment Control (without enrichment), treatment PRope (had 2 pieces of polyester rope), treatment SWood (had 2 pieces of soft wood) and treatment PRope+SWood (had 1 piece of soft wood and 1 piece of polyester rope together making 2 pieces of objects provided). Behavioural observations were monitored using Closed Circuit Television (CCTV) attached to the individual pens and recordings were made for six hours a day, three days a week between the hours of 09:00-12:00 and 15:00 - 18:00. From the video recordings, counting was done for 1 minute at each ten minute. The frequency at which each category of the behavioural ethogram (Table 1) occurred was then expressed as a percentage of the total number of observations according to Scott *et al.*, 2006. Data collected includes performance characteristics; average feed intake, average weight gain and feed conversion ratio, and behavioural observations; enrichment use, general activities, pen manipulation and pen-mate manipulation.

Statistical analysis

Behavioural data obtained from this experiment was analyzed using repeated

measures analysis of variance (ANOVA) procedure of SAS (2010) and performance data analysed using one-way analysis of variance while means were compared using

Duncan's multiple range test of the same software at $\alpha_{0.05}$. Below is the ethogram used in generating behavioural data.

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 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

Source: Trickett *et al.* (2009)

Results and discussion

Performance

Table 2 shows the performance response of growing pigs to single or combination of enrichment. It revealed significant difference ($P < 0.05$) across the treatments in parameters measured. For the final weight, average weight gain and feed intake, Prope+Swood had the highest value of 50.63kg, 15.95kg and 56.16kg respectively, although not significantly different from SWood of 49.25kg, 14.22kg and 56.61kg. The least value for final weight, average weight gain and feed intake was observed with pigs provided PROpe, having 46.46kg, 11.44kg and 49.10kg respectively, which was significantly similar to the control treatment. Consequently, the highest FCR was observed in the PROpe treatment and lowest value in the Prope+Swood treatment. The performance of pigs is crucial as it reflects their response particularly to feed given and their living environment. It is therefore imperative to understand variations in performance of pigs in different rearing environments be it

enriched or barren environments.

The results of this study suggested that, the provision of soft wood (SWood) and combination of soft wood and polyester rope (Prope+Swood) as enrichment objects to growing pigs enhanced growth performance. Johnson *et al.* (2001) working with pigs in outdoor paddocks, reported that pigs preferred some objects over others, this might be responsible for the difference in performance of pigs in this study as objects provided differs. Beattie *et al.* (2000) reported that pigs in an enriched environment had a better feed conversion ratio (FCR) than their counterparts from barren environments and found improvement in the productivity of pigs when enrichment is provided. On the contrary, Trickett *et al.*, 2009 found no improvement in the performance of pigs when different presentation of enrichment using wood block and jute rope was provided for four weeks. Likewise, Caldara *et al.* (2012) reared pigs on compact floor and deep bedding with wood shavings and reported no differences in performance in the growth phase.

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Table 2: performance of growing pigs with single or combination of enrichment objects

Parameters	Control	PRope	SWood	PRope +SWood	SEM
Initial weight(Kg)	35.19	35.02	35.03	34.68	1.47
Final weight (Kg)	47.40 ^b	46.46 ^b	49.25 ^a	50.63 ^a	2.05
Average weight gain (Kg)	12.21 ^b	11.44 ^b	14.22 ^{ab}	15.95 ^a	0.73
Average feed intake (Kg)	50.85 ^{bc}	49.10 ^c	53.52 ^{ab}	56.61 ^a	1.22
Feed conversion ratio (FCR)	4.18 ^{ab}	4.30 ^a	3.80 ^{bc}	3.56 ^c	0.20

^{abc} Means of the same superscript on the same row are not significantly ($P > 0.05$) different, SEM: Standard Error of Means, Control : without enrichment, PRope : 2 pieces of polyester rope, SWood : 2 pieces of soft wood, PRope+SWood : 1 piece of soft wood and 1 piece of polyester rope

Behavioural response of growing pigs to single or combination of enrichment objects

Table 3 reveals the behavioural response of growing pigs to single or combination of enrichment objects. The results indicated significant difference ($P < 0.05$) in all the parameters measured across the treatments. The results of the combination of objects (Prope+SWood) revealed that penmate manipulation (10.48%), pen manipulation (19.02%) and general activities (14.62%) were lower and significantly better than that of only rope, wood and control. This suggested a reduction in adverse behaviours towards pen-mate and pen manipulation according to the ethogram. Consequently, higher interaction with enrichment (55.88%) provided was observed in the PRope+SWood indicating

the preference of growing pigs for objects combination rather than single presentation of the objects. As a result of this, there was diversion of their attention from manipulating pen-mate and pen components towards the enrichment provided (Scott *et al.*, 2006). According to Olsen *et al.*, (2000), the stimulus value of a material is increased and will remain for a longer time if the material is complex, edible and easy to manipulate (Van de Weerd *et al.*, 2003). These characteristics were more evident with the SWood and consequently with PRope +SWood, this might also suggest the better interaction with enrichments in these treatments. Van de Weerd *et al.* (2005) also establish that pigs in barren environments spent more time expressing adverse behaviours such as tail-biting, compared to pigs housed in enriched environments.

Table 3: Behavioural response of growing pigs to single or combination of enrichment objects

Parameter (% of observation)	Control	PRope	SWood	PRope +SWood	SEM
Penmate Manipulation	29.93 ^a	13.69 ^b	12.10 ^c	10.48 ^d	1.08
Pen Manipulation	41.54 ^a	23.44 ^b	21.70 ^c	19.02 ^d	1.28
General Activities	28.54 ^a	17.45 ^b	15.72 ^c	14.62 ^d	0.79
Enrichment Use	0.00 ^d	45.43 ^c	50.48 ^b	55.88 ^a	1.97

^{abc} Means of the same superscript on the same row are not significantly ($P > 0.05$) different, SEM: Standard Error of Means, Control : without enrichment, PRope : 2 pieces of polyester rope, SWood : 2 pieces of soft wood, PRope+SWood : 1 piece of soft wood and 1 piece of polyester rope

Effect of week on single or combination of enrichment on the enrichment use of growing pigs

As shown in figure 1, week had effect on the effectiveness of enrichment use.

Fluctuation in the enrichment use was observed across the treatment up to week five when constant decrease was observed till week eight. It was observed that at every third week, there were increased changes in

enrichment use across the treatments. This is due to the bi-weekly change of enrichment objects indicating that new objects motivate more than old ones. Nevertheless, throughout the experiment, it was observed that the combination of objects in PRope+SWood still maintain the highest level of manipulation. This suggested that combination of enrichment provided the appropriate stimulus that elicited the diversion of adverse behaviour from pen mate and pen components

towards the enrichment provided. However, the increased reduction of the enrichment use from week six might be an indication of habituation to object provided. This study hence, is similar to the findings of Winfield *et al.* (2017) who found out that provision of enrichment objects divert the attention of pigs from performing adverse behaviours up to five weeks. Likewise, Grandin *et al.*, 2003 concluded that devices might lose their ability over time as pigs get habituated to them.

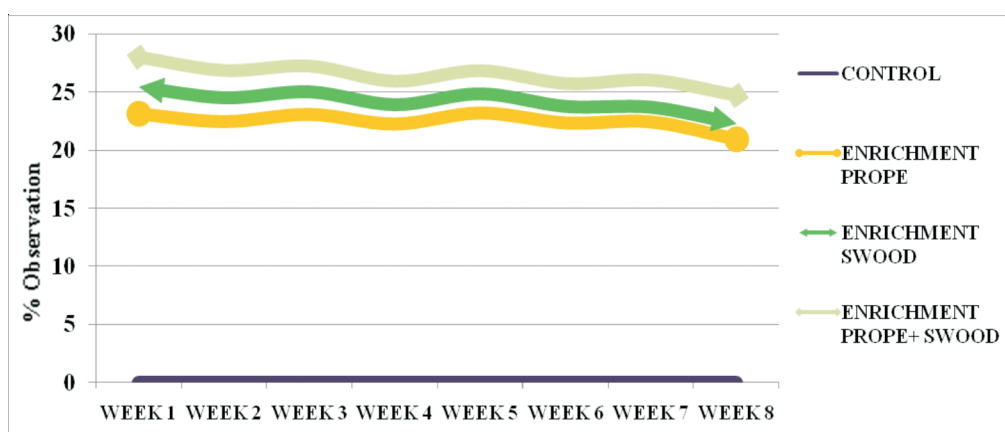


Figure 1: Weekly effect of object combination on enrichment use

Control: without enrichment, PRope: 2 pieces of polyester rope, SWood: 2 pieces of soft wood, PRope+SWood: 1 piece of soft wood and 1 piece of polyester rope

Conclusion

Considering the results of this study, it can be concluded that combination of environmental enrichment devices is required to improve the performance and stimulate the appropriate motivation required in diverting the attention of growing pigs from performing adverse behaviours. Consequently, the application of this experiment is that; it informs farmers on appropriate use of environmental enrichment strategies and how to improve the behaviour and welfare of confined animals.

References

Arey, D. S. 1993. The effect of bedding on the behaviour and welfare of pigs.

Anim. Welf. 2, 235–246

Averós, X., Brossard, L., Dourmad, J. Y., de Greef, K. H., Edge, H. L., Edwards, S. A. and Meunier-Salaün, M.-C. 2010. A meta-analysis of the combined effect of housing and environmental enrichment characteristics on the behaviour and performance of pigs. *Appl. Anim. Behav. Sci.* 2010, 127, 73–85.

Bracke, M. B. M., Zonderland, J. J., Lenskens, P., Schouten, W. G. P., Vermeer, H., Spoolder, H. A. M., Hendriks, H. J. M. and Hopster, H. 2006. Formalised review of environmental enrichment for pigs in relation to political decision

- making. *Appl. Anim. Behav. Sci.* 98:165–182. doi: 10.1016/j.applanim.2005.08.021
- Broom, D. M. 1998.** Welfare, stress, and the evolution of feelings. *Advance Studied Behavior* 1998, vol; 27, 371–403.
- Bruinsma, J. 2009.** *The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050?* Paper presented at the *FAO Expert Meeting on How to Feed the World in 2050*, 24–26 June 2009, Rome.
- Caldara F. R., Rosa P. S. G. and Ferreira R. A. 2012.** Behaviour, performance and physiological parameters of pigs reared in deep bedding. *Eng Agric Jabotical* 2012;32:38–46.
- Compassion in World Farming (CIWF) 2012.** Techniques d'enrichissement pour les porcs. [Online]. <http://www.ciwf.fr/media/29211/ciwf-france-techniques-enrichissement-porcs.pdf>
- Garner, J. P. 2005.** Stereotypies and other abnormal repetitive behaviors: potential impact on validity, reliability, and replicability of scientific outcomes. *ILAR J* 46, 106–117
- Gračner, G. G., Semiga, N., Ostovic, M., Kabalin, A. E., Matkovic, K. and Pavicic, Z. 2013.** The effect of environmental enrichment objects on weight gain in weaned pigs. *VETERINARSKI ARHIV* 83 (3), 333–339
- Grandin, T., Curtis, S. E. and Greenough, W.T. 2003.** Effects of rearing environment on the behaviour of young pigs. *J. Anim.Sci.* (Suppl. 1), 137.
- Johnson, A. K., Morrow – Tesch, J. L. and Mc Glone, J. J. 2001.** Behaviour and performance of lactating sows and piglets reared indoors or outdoors. *J Anim Sci* 2001;79:2571
- Novak, M. A. and Suomi, S. J. 1988.** Psychological well-being of primates in captivity. *Am. Psychol.* 43,765–773.
- Olsen, A. N. W., Vestergaard, E. M. and Dybkjær, L., 2000.** Roughage as additional rooting substrates for pigs. *Anim. Sci.* 49,85–97
- Scott, K., Taylor, L., Gill, B. P. and Edwards, S.A. 2006.** Influence of different types of environmental enrichment on the behaviour of finishing pigs in two different housing systems. 1. Hanging toy versus rootable substrate. *Appl. Anim. Behav. Sci.* 99, 222–229.
- Statista 2018.** Global pork consumption 2014–2026, projected pork consumption worldwide 2016 – Statistic.htm. Retrieved July 24, 2018
- Telkanranta H., Bracke M. B. M. and Valros A. 2014.** Fresh wood reduces tail and ear biting and increases exploratory behaviour in finishing pigs. *Appl Anim Behav Sci.* 161:51–59
- Trickett, L. S., Jonathan, H. G. and Sandra, A. E. 2009.** The role of novelty in environmental enrichment for the weaned pig. *Applied Animal Behaviour Science* 116 (2009)45–51
- Van de Weerd, H. A., Docking, C. M., Day, J. E. L., Avery, P. J. and Edwards, S.A. 2003.** A systematic approach towards developing environmental enrichment for pigs.

- Appl. Anim. Behav. Sci.* 84, 101–118
- Van de Weerd, H. A., Docking, C. M., Day, J. E. L., Edwards, S. A. 2005.** The development of harmful social behaviour in pigs with intact tails and different enrichment backgrounds in two housing systems. *Anim. Sci.* 80, 289–298
- Velarde, A., Fàbrega, E., Blanco-Penedo, I. and Dalmau, A. 2015.** Animal welfare towards sustainability in pork meat production. *Meat Sci.* 2015, 109, 13–17.
- Winfield A. Jade, Macnamara F. Greg, Macnamara L. F. Ben, Hall J. S. Evelyn, Ralph R. Cameron, O'shea J. O. and Cronin M. G. 2017.** Environmental enrichment for sucker and weaner pigs. The effect of enrichment blocks shape on the behavioural interaction by pigs with the blocks. *Animals* (Based) 2017 Dec; 7 (12):91.
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