PERFORMANCE, BEHAVIOUR AND SKIN LESION SCORE OF WEANED PIGS RAISED ON STRAW BEDDED PIGSTIES

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ABSTRACT

Expression of natural behaviours is impeded by lack of rooting materials in modern pigsties, hence, the need to investigate the use of different bedding materials in such environment. Sixty-three weaner pigs were allotted into seven treatments with three replicate each using a factorial arrangement in a completely randomised design in a five weeks' experiment. Two bedding materials Maize Straw (MS) and Guinea Grass straw (GGS) formed the treatments: T1: concrete (without beddings) T2: MS (0.1m high), T3: MS (0.2m high), T4: MS (0.3m high), T5: GGS (0.1m high), T6: GGS (0.2m high) and T7: GGS (0.3m high). Data were collected on growth performance (weight gain, final weight and feed conversion ratio (FCR)), behaviour and skin lesion (front, middle and rear). Interaction between different straws and depths showed no significant (P>0.05) effect on the weight gain and feed intake. However, pigs on 0.2m (GGS) had a significantly (P<0.05) lower value (3.39) of FCR compared with those in the control (4.72). Pigs in the control group spent 11mins exhibiting rooting behaviour which was lower compared with other treatments. Pigs on MS treatments spent more time rooting (T2:40mins, T3:47mins and T4:46mins) compared with T5:32mins, T6:35mins and T7:36mins. Most of the skin lesions occur at the front body part with T1 having the highest on the head (2). The use of GGS at 0.2m depth can improve performance. However, both straw materials are good rooting materials with capacity to reduce skin injuries in pigs.

Keywords: *Behaviour, Growth Performance, Guinea Grass Straw, Maize Straw, Skin Lesion Score, Straw Bedded*

INTRODUCTION

Animal welfare with environmental and food safety are the major challenges of agriculture (Hotzel *et al*., 2005). Intensive indoor-systems are often made up of barren slatted concrete floors with no rooting material. These systems promote boredom and frustration for pigs by precluding the expression of behaviours which are exhibited by pigs under normal circumstances (Studnitz *et al*., 2007). The barren slatted floors may also induce injuries because of behavioural activities such as manipulative oral behaviours, harmful social behaviours and aggressive behaviours directed towards conspecifics (Fraser *et al*., 1991). The barren slatted floors are slippery especially when the pigs have urinated and defecated in the pens. This, in itself, could lead to undesired injuries during aggressive behavioural activities. Pigs in barren, uninsulated concrete floor environments, are also likely to contract pneumonia during cold seasons especially when the room temperature is

not controlled (Gregory, 1998).

In pig farming, welfare conditions should be especially observed at critical stages such as weaning, when piglet performance may be affected by behavioural, physiological, immunological and microbiological changes (Molino and Balbino, 2010). Pig investigated and handled in scientific research must have permanent access to sufficient amount of suitable materials (e.g. straw, hay, wood, sawdust, mushroom compost, peat) that do not compromise their health. The addition of these materials to animal environment is the concept of environmental enrichment, which principle is to increase the quality of life under confined environment by identifying and using environmental stimuli necessary to promote animals with psychological and physiological welfare (Young, 2003). Providing enrichment after weaning may facilitate the weaning process for piglets by giving distraction and has the potential to reduce the cortisol response to weaning (Moncek *et al*., 2004; Dudink *et al.,* 2006).

Environmental enrichment by provision of objects or substrates capable of satisfying the behavioural need of pigs, is a major method to combat animal welfare problems. These objects or materials have the ability to reduce the amount of time pigs spend on harmful social behaviours. Environmental enrichment is therefore, becoming indispensable in intensive production systems to improve animal welfare while maintaining high productivity of pigs (Jansen *et al*., 2009). Pigs in enriched environments are able to perform more of their species – specific behavioural repertoire and accommodate a larger range of behavioural choices (Mason *et al*., 2007). In addition, enriched environments increase activities like exploration, foraging, play and social interaction; which are primary behaviours in pigs. Studnitz *et al*. (2007) concluded that exploratory behaviour of pigs is best stimulated by materials that are complex, changeable, destructible, manipulable and contain sparsely distributed edible parts. Experts on pig welfare assign considerable importance to the availability of a substrate such as straw in their welfare assessments of housing systems (Spoolder *et al*., 2003). Enrichment and flooring are important factors affecting the incidence of injuries and stomach ulcers in pigs. Evaluation of pig behaviours associated with health and welfare were assessed through indicators including presence of lesions on the snout, ears, shoulders, legs and tail. Ramis *et a*l. (2005) found that the prevalence of limb lesions was much greater in barren-housed pigs (24% of observations) compared with pigs housed in sawdust-bedded barns (1% of observations). The effects of enrichment can be examined in different approaches such as behaviour, skin lesion and performance of pigs in enriched environments compared to those in barren environments. These aspects all offer insights on how environmental enrichment improves pig welfare. Guinea grass and maize are indigenous to Africa, widely distributed in West Africa and could therefore help in boosting welfare-friendly pig production systems in Nigeria. Hence, this study was conducted to investigate the growth performance, behaviour and skin lesion score of weaned pigs reared in guinea grass and maize straw bedded pigsties.

MATERIALS AND METHODS

Animals and Husbandary

The experiment was carried out at the Piggery Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Oyo State, Nigeria. The temperature ranges from 21 to 32ºC, humidity 71.53% to 76.00% and an annual rainfall of about 1250 to 1500mm.

Sixty-three (Landrace X Large White) weanling pigs were used for the study. The animals were kept and monitored for one week for acclimatization and proper adaptability before the commencement of the experiment. Animals were fed with commercial feed and water was provided *ad libitum*. The pigs were raised under conducive environmental conditions, with proper management in an intensive system of management.

The study was conducted using a 3x3 factorial arrangement in a completely randomised design (CRD). Sixty-three animals were randomly allotted to seven treatments with nine animals per treatment. T1: Concrete floor, T2: Maize straw bedded floor (0.1m high), T3: Maize straw bedded floor (0.2m high), T4: Maize straw bedded floor (0.3m high), T5: Guinea grass straw bedded floor (0.1m high), T6: Guinea grass straw bedded floor (0.2m high) and T7: Guinea grass

straw bedded floor (0.3m high). The bedding items used were chosen based on their ease of availability.

Behavioural activities

Behavioural activities of pigs in each pen were recorded at day 2, 15 and 34 using direct observation method. Pigs were identified with tattoo markings for accurate identification during observation. Time spent on different activities was observed 3 times for 2 hours, between 10:00hr and 12:00hr. In each pen, one focal pig was selected and was observed throughout the trial. Behavioural activities observed in the study are based on the Ethogram given in Table 1.

Skin lesions

Skin lesions emanating were through aggression and frequency of fighting were assessed on individual pigs in each pen. Recordings were done on fresh lesions which age of scabbing. Lesions on each side of the pig were added to obtain a total of each side and then scored based on the total number of lesions. For the purpose of assessment, the body of the pigs was divided into three parts. Each part received a score based on the number of lesions on it. The parts of the body assessed were:

Front: head, neck, shoulders and front legs
Middle: flanks and back
Rear: rump, hind legs and tail

The checklist for the scoring is as shown in Table 2.

The study was undertaken with the approval

Table 1: Ethogram of Behavioural Activities

Behaviours	Description of Behaviours
Resting	The piglets were sitting or lying on straw, calm and still
Rooting	The piglets were rooting in the straw with their head, chewing it
Standing active	Body weight supported by all four legs
Belly nosing	Pigs massaging the belly of others with the snout
Eating	Consumption of feed material from feeder
Drinking	Drinking from the waterer provided
Tail biting	Having the tail of another pig in its mouth and biting or pulling hard enough to cause a reaction in the other pig
Bullying	Dominance of one pig over another in a fight

(Adapted from Statham et al., 2011; Rhim, 2012)

Table 2: Skin lesion scoring system

Score	Description
0	No injuries
1	One small (≤ 2 cm) superficial (pale red) lesion
2	More than one small (≤ 2 cm), superficial (pale red) lesion; or just one red (deeper than score 1) but still superficial lesion
3	One or several large (≥ 2 and ≤5 cm) and deep lesions. If deep; only one single lesion, if not so deep; several red lesions
4	One very large (> 5 cm), deep and red lesion. Or many large, deep, red lesions
5	Many very large (> 5 cm), deep and red lesions covering the skin area

Source: Björklund (2005)

from the institutional Ethics Committee for Care and Use of animals for research of the host institution.

Statistical analysis

Data obtained were subjected to descriptive statistics and analysis of variance (ANOVA) using SAS 9.2 (2012) Software. Significant means were separated using Turkeys.

RESULTS AND DISCUSSION

Performance Characteristics

The main effect of floor types on performance characteristics of weaner pigs housed on different straw bedded pens is as shown in Table 3. Significant ($p<0.05$) difference were observed in the final weight, weight gain and FCR. However, guinea grass straw and maize straw were significantly similar in all the parameters. The highest results were observed in pigs on guinea grass straw with 9.52kg and 4.32kg in final weight and weight gain respectively while the least values was observed in pigs on control treatment with 8.55kg, 3.34kg for final weight and weight gain respectively.

Table 4 shows the result of effect of straw depth on performance characteristics of weaner pigs housed on different straws. There were no significant difference in the initial weight and feed intake across the treatments. However, the results of the final weight, weight gain and FCR revealed significant ($p<0.05$) difference across the depths. The highest value of final weight and weight gain was observed in the 0.2m depth with 9.76kg and 4.50kg, respectively, while having the least value (3.46) for FCR.

The interaction effect of different bedding straws

Table 3: Main effect of floor type on performance characteristics of weaner pigs housed on different straws

Floor-type	Initial weight (kg)	Final weight (kg)	Weight gain (kg)	Feed intake (kg)	FCR
Control	5.21	8.55^{b}	3.34^{b}	15.73	4.72^{a}
GGS	5.20	9.52^{a}	4.32^{a}	15.62	3.68^{b}
MS	5.29	9.42^{a}	4.18^{a}	15.06	3.62^{b}
SEM	0.17	0.11	0.11	0.45	0.09

ab means on the same column with different superscripts are significantly different($P<0.05$)
Control- Concrete floor; GGS- guinea grass straw, MS-maize straw, SEM- standard error of mean, FCR- feed conversion ratio

Table 4: Effect of straw depth on performance characteristics of weaner pigs housed on different straws

Depth(metres)	Initial weight (kg)	Final weight (kg)	Weight gain (kg)	Feed intake (kg)	FCR
Control	5.21	8.55^{b}	3.34^{b}	15.73	4.72^{a}
0.1	5.21	9.41^{a}	4.21^{a}	15.65	3.75^{b}
0.2	5.26	9.76^{a}	4.50^{a}	15.33	3.46^{b}
0.3	5.27	9.32^{a}	4.05^{ab}	15.03	3.73^{b}
SEM	1.70	1.07	0.11	0.45	0.09

ab means on the same column with different superscripts are significantly different($P<0.05$)
Control- Concrete floor; GGS- guinea grass straw, MS-maize straw, SEM- standard error of mean, FCR- feed conversion ratio

and depths on performance characteristics of weaner pigs is as shown on Table 5. Significant effects of the interaction shown across the treatments were in the final weight and FCR. However, the actual effect was among the concrete floor (8.55kg) and 0.2m GGS (9.94kg) for the final weight with others significantly similar to them. In addition, pigs on concrete floor (4.72) had the highest FCR, while the least was observed in pigs on 0.2m GGS (3.39). Environmental enrichment is crucial for pig production as it reflects in their performance and welfare. It is therefore imperative to understand variations in performance of pigs in different rearing environments be it indoor, outdoor, enriched and barren environments. This enables pig producers to manage pigs differently to improve the performance and welfare of their pigs. In this study it was observed that treatments with beddings had higher values for final weight and weight gain. This corroborates the findings of Vanheukelom *et al*. (2011) who reported an increase in post weaning weight gain for pigs housed in an enriched environment. In the study of Van de Weerd and Day (2009) using different enrichment substrates, it was reported that pigs housed in straw-bedded pens had a higher daily weight gain than their counterparts. Likewise, Beattie *et al.* (2000) observed that pigs in enriched environments had higher growth rates, which was attributed to higher feed intake. Conversely, Jordan (2013) reported that straw and hay did not influence growth rates of pigs. It was also observed in this study that the FCR across the treatments for pigs raised on beddings was better compared with their counterparts on concrete floor. This is in agreement with the report of Beattie *et al.* (2000) who observed a similar trend in pigs reared on wood shavings as against concrete floor. Enriching the environment improves the growth rates of pig, and the predisposition to increased stress levels in control treatment (concrete floor) could be the reason why these pigs had lower performance rates than pigs in enriched environments. Barnett *et al.,* (1992) reported that higher levels of stress adversely affected feed conversion ratio. Differences in management and potential differences in behaviour may have altered the performance of pigs in barren environments.

Behavioural Observation

Figure 1 shows the behavioural observation of weaner pigs on different bedding materials on day 2. Pigs on concrete floor were observed to have spent 11mins exhibiting rooting behaviour which was lower compared with other treatments. However, pigs on Guinea grass straw (0.1m GGS (32mins), 0.2m GGS (35mins), 0.3m GGS (37mins)) spent lower time than pigs on Maize straw (0.1m MS (40mins), 0.2m MS (48mins), 0.3m MS (47mins)) rooting. Conversely, pigs on concrete floor spent more time being active, belly nosing, bullying, tail biting

Table 5: Interaction effect of different straw and depths on performance characteristics of weaner pigs

Floor type	Depth(m)	Initial weight (kg)	Final weight (kg)	Weight Gain (kg)	Feed intake (kg)	FCR
Control	-	5.21	8.55^{b}	3.34	15.73	4.72^{a}
	0.1	5.12	9.40^{ab}	4.28	15.60	3.68^{ab}
GG	0.2	5.19	9.94^{a}	4.75	15.69	3.39^{b}
	0.3	5.28	9.22^{ab}	3.94	15.56	3.98^{ab}
	0.1	5.30	9.43^{ab}	4.13	15.71	3.83^{ab}
MS	0.2	5.33	9.58^{ab}	4.25	14.97	3.53^{b}
	0.3	5.25	9.41^{ab}	4.16	14.51	3.49^{b}
SEM	-	0.45	0.28	0.10	0.50	0.09

ab means on the same column with different superscripts are significantly different($P<0.05$)
Control- Concrete floor; GGS- guinea grass straw, MS-maize straw, SEM- standard error of mean, FCR- feed conversion ratio

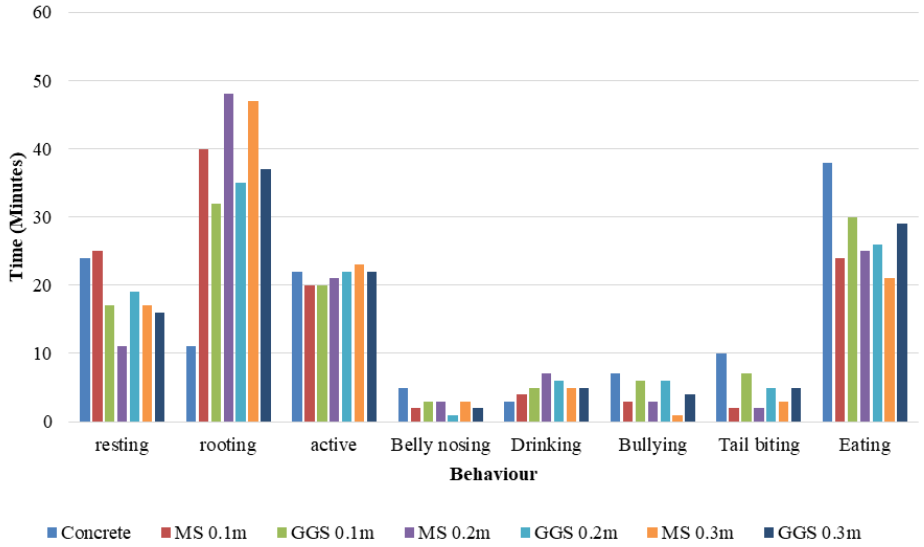

Figure 1: Behavioural observation of weaner pigs on different materials at day 2 Control: *Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high.*

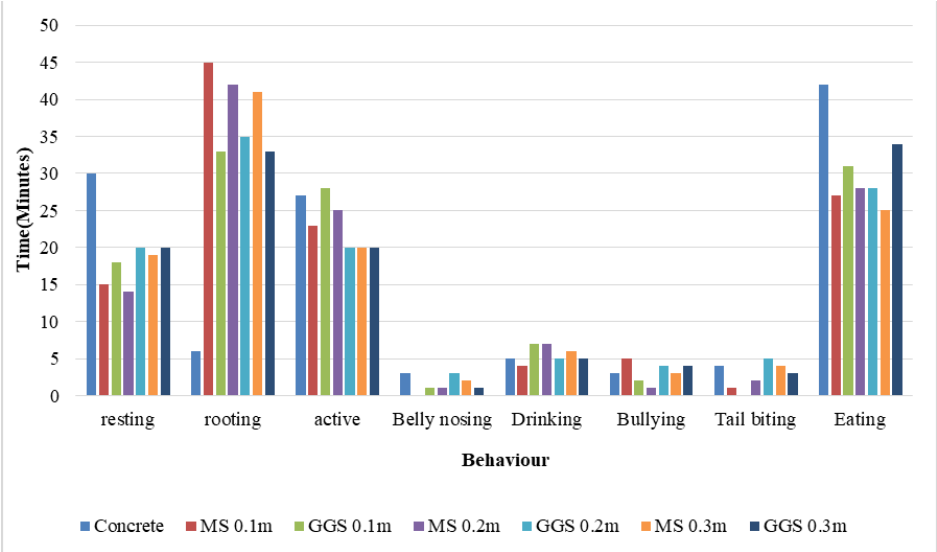

Figure 2: Behavioural observation of weaner pigs on different bedding materials at day 15 Control: *Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high.*

and eating on day 2 compared with other treatments.

Shown in Fig 2 is the behavioural observation of weaner pigs on different bedding materials on day 15. Pigs on 0.1m MS did not spent any time on belly nosing as observed from the figure. Conversely, pigs kept on 0.1m MS spent higher time (5mins) bullying as compared to pigs kept on other treatments which were concrete (3min), 0.1m GGS (2mins), 0.2 MS (1min), 0.2m GGS (4mins), 0.3m MS (3mins) and 0.3m GGS (4mins).

Pigs on 0.1m GGS did not record any tail biting on day 15, whereas the highest time spent on tail biting was observed in GGS 0.2m (5mins). However, pigs kept on concrete floor bedding spent higher time eating, an average of 42mins, when compared with other treatments.

Figure 3 showed the behavioural observation of weaner pigs on different bedding materials on day 34. Pigs on concrete floor spent lower time rooting (2mins),however pigs kept on 0.1m MS (40mins) spent the highest time rooting compared to 0.2m GGS(31mins) which spent the least time. Conversely, pigs on concrete, 0.1m MS, and 0.2m GGS spent no time performing belly nosing while others (GGS 0.1m (1min), MS 0.2m (2mins), MS 0.3m (1min) and GGS 0.3m (1min)) spent little time performing it. Pigs on concrete floor spent 46mins on eating, which was highest compared to other treatments. The environment affects pig behaviour as pigs in semi-natural environment spend most of their time foraging, rooting, chewing and exploring the environment. In intensive husbandry, the pigs are highly motivated to exhibit these exploring activities, even if access to food and straw is limited. This can create disturbances in the behaviour for pigs held in barren environment and can result in a manipulative behaviour directed towards pen mates.

Similar to results found in other studies, animals housed in a barren (control) environment exhibited the highest levels of behavioural vices (Beattie *et al*., 1995), perhaps due to a lack of environmental challenge (Wemelsfelder and Birke, 1997). Specifically, Petersen *et al.* (1995)

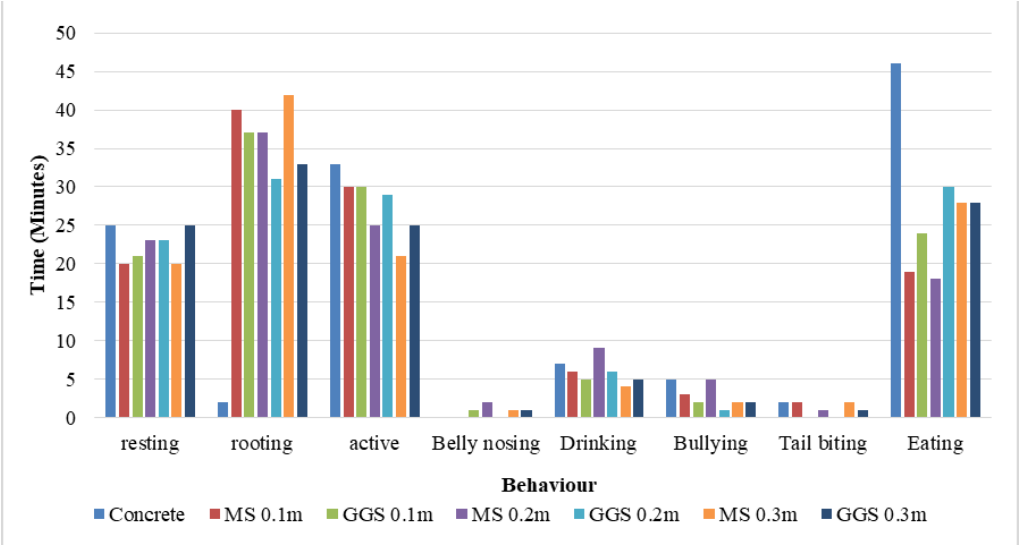

Figure 3: Behavioural observation of weaners on different bedding materials at day 34 Control: Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high.

reported that pigs housed in pens enriched with straw, logs, and branches spent more time rooting, biting, and chewing the provided materials, whereas pigs housed in barren environments spent more time rooting, biting, and chewing the floors and walls of their pen. These findings suggest that any environmental enrichment that promotes exploration is an outlet for oral activities which may be the most effective means of redirecting oral vices away from pen fittings and pen mates in order to improve animal well-being. Beattie *et al.* (2001) also reported that pigs with access to spent mushroom compost exhibited less nosing, biting, and chewing behaviours directed toward pen mates, which resulted in fewer animals needing to be removed due to tail biting and this suggests that pigs redirect rooting behaviour toward pen mates and the feeder in the absence of any rooting substrate.

Day *et al.* (2002) studied the effects of straw on the behaviour of growing pigs and found that if pigs are provided with straw, which does not continue into the grow-finish phase of development, the result can be an increase in the occurrence of adverse pen mate-directed behaviour. However, even a small amount of straw in the grow-finish environment may serve to buffer the negative effects of the change in housing environment.

Skin Lesion Observations

The mean skin lesion scores on the front body part among the treatments are reported in Fig. 4. It was observed that the control (concrete floor) had lesions for the various parts and also recorded the highest score (2) for head among the treatments. GGS 0.3m and MS 0.1m only had observable lesions at the front leg, while MS 0.2m and MS 0.3m had no lesion in the entire region observed. Mean skin lesion scores on the middle body parts of the pigs among the treatments are as reported in Fig. 5. GG 0.1m and 0.3m had no lesions recorded. However, lesions were recorded for all other treatments with the highest score recorded in MS 0.2m. Mean skin lesion scores on the rear body part of the pigs among the treatments are as shown in Fig. 6. Lesions were recorded for GG 0.1m (in the hind leg) and control (in the hind leg and tail). Other treatments had no lesion. In this study, it was

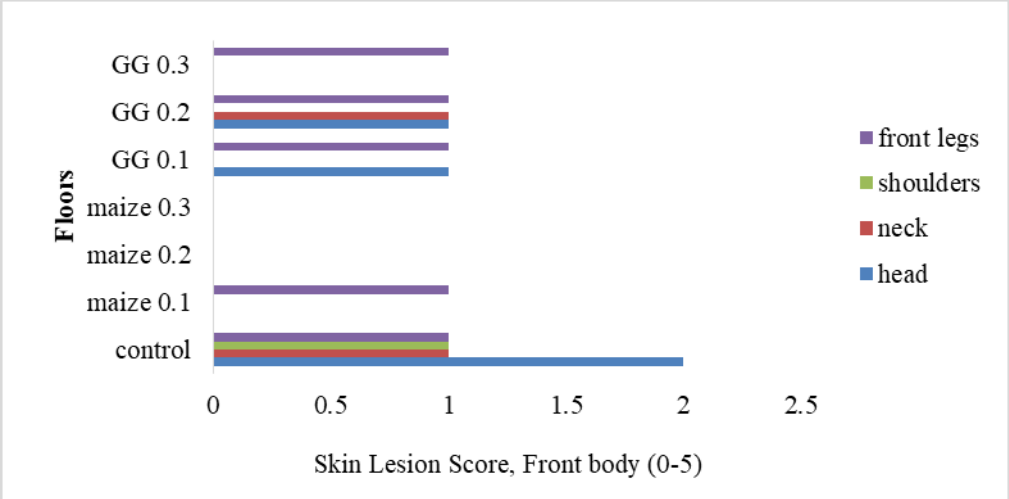

Figure 4: Mean skin lesion on the front body part of the pigs among the treatments

Control: Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high.

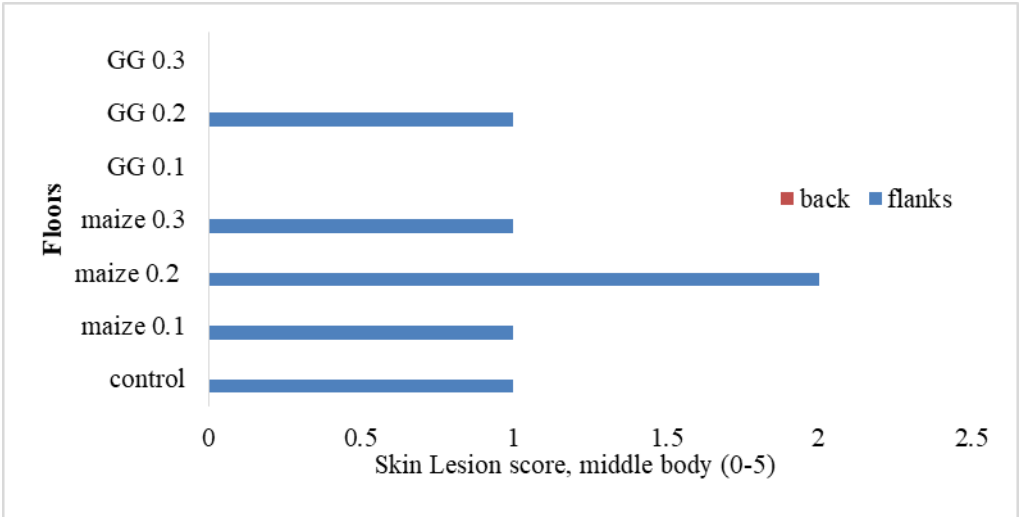

Figure 5: Mean skin lesion score on the middle body parts of pigs among the treatments
Control: Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high

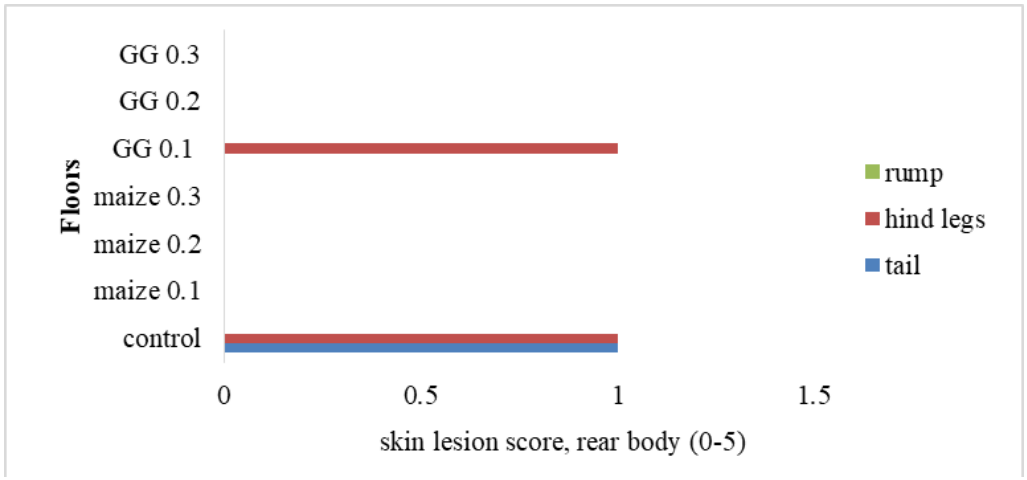

Figure 6: Mean skin lesion score on the rear body part of the pigs among the treatments
Control: Concrete at 0metres high; Maize 0.1: Maize straw bedding at 0.1metres high; Maize 0.2: Maize straw bedding at 0.2metres high; Maize 0.3: Maize straw bedding at 0.3metres high; GG 0.1: Guinea grass bedding at 0.1metres high; GG 0.2: Guinea grass bedding at 0.2metres high; GG 0.3: Guinea grass bedding at 0.3metres high.

observed that the provision of straw beddings was beneficial to the pigs as most of the lesions recorded were from pigs housed on concrete floor which might be due to the absence of explorative materials that could help divert the attention of the pigs. This agrees with the findings of Ramis *et al*. (2005) who reported that the prevalence of limb lesions was much greater in barren-housed pigs (24% of observation) compared with pigs housed in sawdust-bedded barns (1% of observations). It has been suggested that play is important for the development of social skills (Van den Berg *et al.*, 1999; Chaloupková *et al*., 2007) and intraspecific communicative signals, which might serve to inhibit aggression and to increase group stability (Van der Schuren *et al.*, 1997).

CONCLUSION

Strawbedding helped in manipulating the behaviour of weaned pig which is important in welfare improvement of the pigs. It was revealed that both straw materials were good rooting and welfare-friendly material that has a larger capacity to stimulate extended explorative behaviour of pigs. Also, it is a good absorbent material providing dry surface for pigs.

Pig behaviour is a positive indicator of its welfare condition. A good understanding of the behaviour of pigs can help to identify and improve pig welfare by designing systems that enhance positive welfare. The study revealed that pigs on straw bedded pens reduced time spent being inactive and time spent being involved in harmful social and aggressive behaviour such as tail biting, while increasing the time spent on exploratory behaviour such as rooting. Environmental enrichment with straw bedding increased the interaction of animals, allowing them to exhibit natural behaviours.

Conflict of interest statement

The authors declare no real or perceived conflicts of interest

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