

Straw bedded pigsties height: Effect on growth and skin lesion of pigs

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Abstract

In order to ensure sustainable pig production in most tropical countries, alternative flooring systems need to be investigated and adopted. This five-week experiment was carried out to investigate the growth performance and skin lesion score of 36 weaned pigs raised on different heights of Guinea Grass Straw (GGS) beddings. The pigs were separated into four treatments in triplicate, in a completely randomized design. The treatments were: T1: 0m (concrete floor: without GGS), T2: 0.1m GGS, T3: 0.2m GGS and T4: 0.3m GGS. At the end of the experiment, data were collected on growth performance: final weight, weight gain, feed intake while feed conversion ratio (FCR) was calculated and skin lesions (front, middle and rear) measured. All data obtained were subjected to analysis of variance (ANOVA). Pigs on 0.2m had the highest ($p < 0.05$) weight gain (4.75kg) compared with its counterparts on 0.1m (4.28kg), 0.3m (3.94kg) and T1 (3.34kg). Final weight followed similar trend with pigs in 0.2m (9.94kg) having the highest weight compared with 0.1m (9.40kg), 0.3m (9.22kg) and T1 (8.55kg). The highest FCR (4.72) was recorded for pigs on 0m (control) which was an indication of poor feed utilisation while the least was with pigs on 0.2m (3.39). The result for skin lesion for the different parts revealed the least lesion occurred in pigs on 0.3m and higher occurrence in pigs on T1. Generally, skin lesions occur most at the front legs and heads. It can be concluded that the use of guinea grass straw at 0.1m and 0.2m height can improve the performance of weaned piglets while a height of 0.3m results in reduced skin lesions score.

Keywords: Bedding, environmental enrichment, guinea grass, weaned pigs

La Hauteur des porcheries à litière de paille : effet sur la croissance et les lésions cutanées des porcs



Résumé

Afin d'assurer une production porcine durable dans la plupart des pays tropicaux, des systèmes de revêtement de sol alternatifs doivent être étudiés et adoptés. Cette expérience de cinq semaines a été réalisée pour étudier les performances de croissance et le taux de lésion cutanée de 36 porcs sevrés élevés sur différentes hauteurs de litières de paille de guinée (le 'GGS'- paille d'herbe de Guinée). Les porcs ont été séparés en quatre traitements en triple, dans une conception complètement aléatoire. Les traitements étaient: T1: 0 m (sol en béton: sans GGS), T2: 0,1 m 'GGS', T3: 0,2 m 'GGS' et T4: 0,3 m 'GGS'. À la fin de l'expérience, des données ont été recueillies sur les performances de croissance: poids final, gain de poids, prise alimentaire tandis que le ratio de conversion alimentaire (FCR) a été calculé et les lésions cutanées (avant, milieu et arrière) mesurées. Toutes les données obtenues ont été soumises à une analyse de variance (ANOVA). Les porcs sur 0,2 m avaient le gain de poids le plus élevé ($p < 0,05$) (4,75 kg) par rapport à leurs homologues de 0,1 m (4,28 kg), 0,3 m (3,94 kg) et T1 (3,34 kg). Le poids final a suivi une tendance similaire avec les porcs de 0,2 m (9,94 kg) ayant le poids le plus élevé par rapport à 0,1 m (9,40 kg), 0,3 m (9,22 kg) et T1 (8,55 kg).

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Le FCR le plus élevé (4,72) a été enregistré pour les porcs à 0 m (témoin), ce qui était une indication d'une mauvaise utilisation des aliments, tandis que le moins était pour les porcs à 0,2 m (3,39). Le résultat de la lésion cutanée pour les différentes parties a révélé que la moindre lésion était survenue chez les porcs à 0,3 m et plus chez les porcs en T1. En général, les lésions cutanées surviennent le plus au niveau des pattes avant et de la tête. On peut en conclure que l'utilisation de paille d'herbe de Guinée à 0,1 m et 0,2 m de hauteur peut améliorer les performances des porcelets sevrés tandis qu'une hauteur de 0,3 m entraîne une réduction du score des lésions cutanées.

Mots clés : litière, enrichissement de l'environnement, paille d'herbe de Guinée, porcs sevrés

Introduction

Pig farming has been considered to be a demanding activity in the context of weaning which could possibly influence piglet performance through internal and external indicators such as behavioural displays, immunological, microbiological and physiological changes (Molino and Balbino, 2010). This habitually necessitates a shift in the physical and social environment. Depressed immune system, upraised concentrations of plasma cortisol, amplified aggression, distress calling, exploiting of pen mates (inclusive of tail biting and belly nosing), growth challenges, low feed consumption and despair are observed (Donaldson *et al.*, 2002). Therefore, exceptional observation of the welfare conditions is principal at this critical stage. Consequently, specialists on pig welfare allot substantial significance to the accessibility of substrates like straw as part of assessing the welfare of housing systems (Spooler *et al.*, 2003) which makes it essential. The addition of these materials to confined housing elucidates the notion of environmental enrichment (Van de Weerd and Day, 2009) and is to enhance the quality of life by instigating the environment to provide the necessary stimuli desired in promoting the physiological and psychological welfare of animals (Young, 2003). Casal-Plana *et al.*, (2017) emphasized that enrichment materials are also capable of helping to minimise the time pigs spend on harmful social behaviours. In intensive production

systems, pigs in enriched environments have been discovered to have a greater variety of behavioural adoptions thus they are competent in carrying out an array of their species – specific habits (Mason *et al.*, 2007). Supplying enrichments after weaning can therefore ameliorate the hassle of weaning process (Dudink *et al.*, 2006).

Studnitz *et al.* (2007) established that the exploratory habit of pigs is best inspired by materials that are complex, usable, destructible and comprising sparsely dispersed parts that are palatable. Enrichment materials that are suitably capable of meeting these measures are ingestible rooting materials like straws and compost or earth (Casal-Plana *et al.*, 2017), especially where these contain edible material as plant roots. Also, many quality assurance schemes for pork such as Freedom Food (RSPCA, UK) prescribe a production system with compulsory provision of straw or other rooting substrates, emphasizing the fact that pigs expend approximately 80% of their time lying down (Ekkel *et al.*, 2003), adequate lying comfort is important for their welfare. Straw tends to relieve the effects of stress that emanates from concrete "oors (Van de Weerd *et al.*, 2003). According to Day *et al.* (2002), straw greatly minimizes the event of likely damaging behaviours in pigs especially when the quantity is increased. A series of multiple-choice tests demonstrated that piglets prefer insulating "oor types to bare "oors made of metal or wire mesh (Pedersen *et al.*, 2007). Weaners

are more inclined to lie on straw in a cold environment but prefer plain floors at higher temperatures (Phillips *et al.*, 2000). Bolhuis *et al.*, (2005) pointed out that pigs raised on barren floor have prevalence of skin lesions. A thin layer of wood shavings has also been connected with an increased possibility of forelimb skin abrasions among piglets, while the presence of straw has been associated to a minimised occurrence of sole bruising (Moultotou and Hatchell, 1999). These authors came to a conclusion that straw is a more resilient and acceptable substrate for piglets to move and relax on; it maximizes floor contact and decreases loading on the hooves. Spooler (1998) emphasized that the supply of straw may cushion the negative effects in group-housed sows in the context of low feed level on weight and back fat gain. Straw may not only increase satisfaction but also the total time spent processing and ingesting food. Kelley *et al.* (1980) reported that straw has a lesser impact on aggression among pigs fed ad libitum than pigs with restricted feeding. Moreover, research by Olsen (2001) showed that oral behaviour directed at both group mates and equipment, and skin injuries can be minimised among pigs by allowing access to roughages. Maw *et al.* (2001) established that bacon of superior eating quality was obtained from pigs kept in straw-bedded housing in comparison with pigs in barren housing systems. In the same vein, Hotzel *et al.* (2009) asserted that pigs housed in bedded pens with either wood shavings or rice husks than concrete floor had better performance and meat quality. In order to reach the anticipated development in the environmental, economic and welfare of livestock production (Appleby, 2005; Steinfeld *et al.*, 2006), the choice of substrate for bedding should be based on a range of criteria, including cost, regional availability, practical aspects related to use, resulting environmental and agronomic qualities

after composting of the bedding, and the performance and welfare of the animals. Guinea grass (*Panicum maximum*), which is a form of straw, is indigenous to Africa, widely distributed in West Africa and grows naturally in many parts of Nigeria, this could therefore help in boosting welfare-friendly pig production systems in Nigeria. Evaluation of pig behaviours associated with health and welfare can be assessed through indicators such as presence of lesions on the snout, ears, shoulders, legs and tail. Ramis *et al.* (2005) found that the prevalence of limb lesions was much greater in barren-housed pigs (24% of observations) compared to pigs housed in sawdust-bedded barns (1% of observations). Hence, this study was conducted to investigate the growth performance and skin lesion score of weaned pigs reared on different height of guinea grass bedding material.

Materials and method

The experiment was carried out at the Piggery Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Oyo State. Thirty-Six (36) (Land race X Large white) weanling pigs were used for the study. These animals were allotted randomly into four treatments in a completely randomised design. Each treatment had three replicates and each replicate contained three pigs.

The experimental layout is stated thus:

Treatment (T1) = Control: concrete floor (without Guinea Grass Straw); Treatment (T2) = 0.1m high GGS; Treatment (T3) = 0.2m high GGS; Treatment (T4) = 0.3m high GGS

The animals were kept and monitored for one week for acclimatization and proper adaptability before the commencement of the experiment. Feeds were formulated to meet the requirement of the animals and made available twice a day based on body

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weight with provision of water ad libitum. The trial lasted for five weeks. Growth performance data were collected on initial weight, feed intake, weight gain and final weight. The feed intake and body weight of pigs were measured weekly using a weighing scale (Camry, 25kg capacity). 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.

For the purpose of skin lesion 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: (1) front (head, neck, shoulders and front legs), (2) middle (flanks

and back) and (3) rear (rump, hind legs and tail). To keep the scores consistent throughout the experiment direct observation of the skin following the checklist of Björklund (2005) in table 1 was used. All lesions were assessed by the same observer throughout the study and percentage of observation of each part assessed across the treatments was then calculated using:

$$\% \text{ of observation} = \frac{\text{number of observations in a treatment} \times 100}{\text{Total number observed in all treatments}}$$

Statistical analysis

All data obtained were subjected to analysis of variance (ANOVA) using SAS 9.2 (2012) software. Means were separated using Duncan's Multiple Range Test (DMRT) of the same statistical software.

Table 1: Skin lesion scoring system

Score	Description
0	No injuries
1	One small (< 2 cm) superficial (pale red) lesion
2	More than one (< 2 cm) superficial (pale red) lesion; or just one red (deeper than score 1) but still superficial
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 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)

Results and discussion

Performance characteristics

The effect of different heights of guinea grass straw beddings on performance characteristics of weaned pigs was as shown in table 2. The average initial weights ranged from 5.12 kg to 5.28 kg. There was no significant effect ($p > 0.05$) of the different straw height on the feed intake, however, pigs on 0m (concrete floor) consumed more feed (15.73 kg) while pigs on 0.2m and 0.3m had 15.56 kg of feed consumption. Weight gain of pigs on 0.2m (4.75kg) was highest and significantly

($p < 0.05$) different from pigs on 0m (3.34 kg). Final weight followed the same trend with pigs on 0.2m (9.94kg) having the highest ($p < 0.05$) weight compared to 0m (8.55 kg). Highest ($p < 0.05$) FCR was recorded with pigs on 0m (4.72) while the least was with those on 0.2m (3.39) indicating better utilization of feed by pigs on 0.2m.

Environmental enrichment is crucial for pig production as it reflects in their performance and welfare. According to Peeters *et al.* (2006), provision of straw beddings for pigs in confined housing

systems positively impacts weight gain even within a short time span as 2 weeks. In this study, it was observed that treatments with beddings had higher values for final weight and weight gain compared to the control (without beddings). This substantiates the findings of Vanheukelom *et al.* (2011) that reported an increase in post weaning weight gain for pigs housed in an enriched environment. Likewise, Van de Weerd *et al.*, (2006) using different enrichment substrates, reported that pigs housed in straw-bedded pens had higher daily weight gain than their counterparts. 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 were lower in treatments with beddings when compared with the control treatment. This could be as a result of the pigs deriving certain nutrient from the consumption of straw. Straws are high in fibre and fibres enhance digestion process thus resulting in the lower FCR recorded. This is in agreement with the report of Beattie *et al.* (2000) that observed a similar trend in pigs reared on wood shavings as against concrete floor.

Table 2: Effect of different height of guinea grass straw beddings on performance characteristics of weaned pigs

Treatments (GGS bedding height in meters)	Initial weight(kg)	Feed intake(kg)	Weight gain(kg)	Final weight(kg)	FCR
0 (Control)	5.21	15.73	3.34 ^b	8.55 ^c	4.72 ^a
0.1	5.12	15.60	4.28 ^{ab}	9.40 ^{ab}	3.68 ^b
0.2	5.19	15.56	4.75 ^a	9.94 ^a	3.39 ^b
0.3	5.28	15.56	3.94 ^{ab}	9.22 ^{bc}	3.98 ^{ab}
SEM	0.22	0.05	0.17	0.11	0.13

^{a,b,c} means on the same column with different superscripts are statistically significant (P<0.05)

0m: Control (T1), 0.1m: T2, 0.2m: T3, 0.3m: T4, SEM: Standard error of means; FCR: Feed conversion ratio

Skin lesion observations

The percentage of skin lesion score on the front body part (front leg, shoulder, neck and head), middle body part (flank and back) and rear body part (rump, hind leg and tail) among the treatments was as reported in table 3. It was observed that the experimental animals in the control (0m) had lesions at the various front body parts (front legs (25%), shoulder (100%), neck (50%) and recorded the highest score (50%) for head. Occurrence of lesion was least recorded with pigs on 0.3m GGS, where lesion was observed only at the front leg (25%). For the flank, pigs on 0.1m GGS and 0.3m GGS had no record of lesions, however, pigs in the control (0m) and 0.2m

recorded a lesion score of 50% each. However, the control (0m) pigs had lesion records for hind leg (50%) and tail (100%) while pigs on 0.1m had 50% lesion record for hind leg. The provision of guinea grass bedding in this study was beneficial to the pigs as most of the lesions recorded were from pigs housed in pens with concrete floor. This agreed with the findings of Ramis *et al.* (2005) on prevalence of limb lesions in barren-housed pigs (24% of observation) compared with pigs housed in sawdust-bedded barns (1% of observations). Specifically, Peterson *et al.* (1995) reported that pigs housed in pens enriched with straw, logs, and branches spent more time rooting, biting, and

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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 and outlet for oral activities may be the most effective means of redirecting oral vices away from pen

fittings and pen mates in order to improve animal well-being. This might explain the reason why in this study, tail lesion was only recorded in the control (without guinea grass straw) since there was absence of explorative materials that could help divert the attention of the weaner pigs.

Table 3: Skin lesion score on body parts of experimental pigs in percentage of total observation

Treatments (GGS bedding height in meters)	Head	Neck	Shoulders	Front legs	Flanks	Back	Rump	Hind legs	Tail
0	50.00	50.00	100.00	25.00	50.00	0.00	0.00	50.00	100.00
0.1	25.00	0.00	0.00	25.00	0.00	0.00	0.00	50.00	0.00
0.2	25.00	50.00	0.00	25.00	50.00	0.00	0.00	0.00	0.00
0.3	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00

0m: Control (T1), 0.1m: T2, 0.2m: T3, 0.3m: T4

Conclusion

It is therefore, concluded that guinea grass height of 0.1m and 0.2m are preferred for the enhancement of the conventional concrete floor in consideration for growth performance, while height of 0.3m is excellent enhancement of concrete floor in terms of skin lesion occurrence.

Acknowledgement

The authors will like to appreciate the efforts of Tolno Haly, Kadiri Ibukun and Idahosa Promise in making this experiment a success, thanks a million times.

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Received: 29th July, 2020

Accepted: 20th December, 2020