

## **Supply of wood as environmental enrichment material to post-weaning piglets**

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**Abstract.** Slatted flooring is a common system used for post-weaning of piglets. In this condition of breeding, it is very hard to provide materials for environmental enrichment to enable proper investigation and manipulation activities to improve animal welfare.

The research aimed to identify an alternative way to provide natural environmental enrichment during post-weaning on slatted flooring using wood. Core of veneer poplar logs and wood sawdust pressed briquettes were selected among other types of wood thanks to their wide availability and low cost. Moreover, these kinds of wood can be used without compromising the health of the animals, neither by contact nor by ingestion.

The most important step of the research was to design systems to make the wood more attractive for piglets. The developed devices consisted of a fixed structural component to be installed inside the pen to which wood materials could be added and replaced quite effortlessly.

Three devices were developed: a) horizontal system, b) vertical system, c) pendulum system. They were tested in three different pens, each one with 24 post-weaning piglets.

The results confirmed the assumption that there is a relation between the level of activity of the animals and the interaction with the wood proposed in the shape of small logs and briquettes. In particular the device a) can generate a valuable level of interaction of the animals reared inside the pen, especially in the first 10 days post-weaning, which is the most sensitive period for piglets after mixing.

**Key words:** Slatted flooring, piglets, welfare, environmental enrichment, wood, briquettes, poplar logs.

### **INTRODUCTION**

Since many years, the negative effects of mixing unfamiliar piglets in post-weaning barren environment are well known (Meese & Ewbank, 1973). More recent studies (Li & Wang, 2001; Paratt et al., 2006) confirm that this problem is far from being solved. Merlot et al. (2004) described the behavioural, endocrine and immune consequences on animal welfare, but despite the economic impact, this operation is almost inevitable in modern commercial system (Hillmann et al., 2003).

In the past, the best practices to alleviate the complications of mixing piglets were at the discretion of the individual farmers and local controllers, possibly assisted by instruments for monitoring the pig welfare (Barbari et al., 2008; Gastaldo et al., 2014). With the introduction of the Directive 1991/629/EC, followed by Directives 2001/93/EC and 2008/120/EC (2009) of the European Union, some measures to improve the welfare

of pigs have become mandatory. Concerning the environmental enrichment, the law provides that the pigs must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of them, not compromising the health of the animals.

The impact of some of these materials on the behaviour of pigs has already been studied (Jensen & Pedersen, 2008). The involvement of straw has been particularly investigated (Scott et al., 2006; Van de Weerd et al., 2006; Bulens et al., 2016), but also the use of other materials has been object of researches, such as mushrooms (Beattie et al., 2001), roughages (Olsen, 2001) or even wood chips (Jensen & Pedersen, 2010). However, none of the above-said materials offered directly to the animals in the pen is suitable for slatted flooring (Telkänranta et al., 2014), that is a very common solution of farm paving. Straw and other materials tend to slide into the slots and clog the cleaning system. Therefore, in these farms it is necessary to introduce material for environmental enrichment in different form, with large volume and strong texture. Wood is the natural material that is suitable for this employment, versatile and easy to work. Nowicki et al. (2007a) obtained positive results by offering a fixed wooden ball, also in aromatized version, to newly mixed weaner pigs. In a recent study Nannoni et al. (2016), analysing the effectiveness of the enrichments in terms of animal behaviour, cortisol from bristles, hematologic and hematic profiles, cutaneous (skin and tail) lesions, stated that hanging chains can provide a sufficient environmental enrichment for undocked piglets, even when compared to more attractive enrichments (e.g. an edible block).

About the position of the enrichment devices in the pen, if free toys lay on the floor, they can be soiled by faecal material and can be pushed under the trough or into neighbouring pens. Grandin (1989) found that when objects offered to pigs became dirty with excreta, the pigs lost interest in them.

Post-weaning enrichment can also affect behaviour by more indirect ways such as a reduction of stress or by providing distraction (Oostindjer et al., 2011). Piglets may be less motivated to show aggression to establish a rank order directly after weaning if the enrichment is enough interesting, resulting in lower levels and perhaps different types of aggression (Melotti et al., 2011). Enrichment of the post-weaning environment seems important in improving performance and health of newly weaned pigs (Oostindjer et al., 2011).

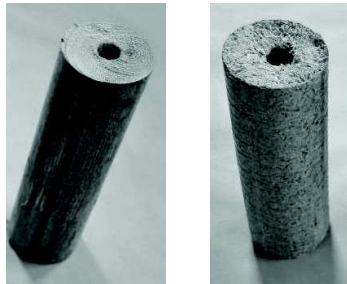
The research aimed to identify a proper way to provide natural environmental enrichment during post-weaning on slatted flooring using wood. Therefore, in this study systems utilizing wood were designed to be fixed in the pen.

## **MATERIALS AND METHODS**

### **Development of devices**

In order to select the best types of wood for the purpose of research, many available species were catalogued according to their features. Afterwards, the toxic species and those with thorns and spines that can hurt the animals were excluded. In addition, species that require substantial pesticide treatments during their life cycle were kept out. The selection was completed considering also the parameter of the cost. As result, core of veneer poplar logs and wood sawdust pressed briquettes were selected among all possible types (Fig. 1). Moreover, these two materials are the most suitable for chewing.

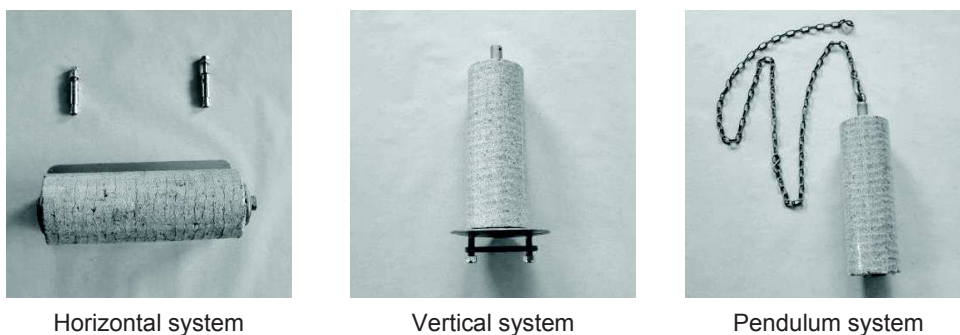
The main characteristics of the materials used in the trials were: cylindrical shape, diameter 8 cm, length 25 cm. The mass of a volume unit (humidity 12%) was  $636 \text{ kg m}^{-3}$  for core of veneer poplar logs,  $360 \text{ kg m}^{-3}$  for wood sawdust pressed briquettes.



**Figure 1.** Selected types of wood (left: core of veneer poplar log; right: wood sawdust pressed briquette).

The design process took into account both the point of view of the animal and of the farmer. Therefore, the characteristics of piglets in post-weaning phase were evaluated: weight, height, inclination degree of the head, starting point of the exploration, etc. The devices were designed to allow the animals to manipulate the material with their legs, but especially with the snout. The wood was linked to the device leaving the possibility to move it in one or more directions.

On the other side, the systems were planned to require less labour possible once installed. For that reason, the piece of wood to be inserted in the device had to be standardized (Fig. 1) in order to reduce the effort of replacing it. Three devices were developed. In relation to the position given in the pen, the systems were called: a) horizontal, b) vertical, c) pendulum (Fig. 2).



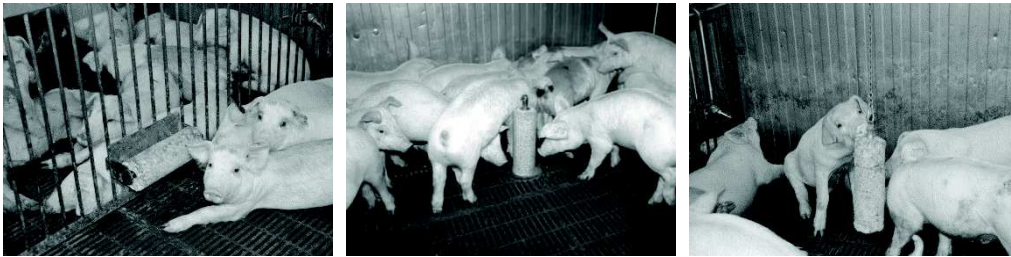
**Figure 2.** Devices to place in the pens in three different ways.

### Test

A trial was arranged to test two hypotheses. The first one was that the three developed devices generate a different level of interaction by the piglets. The second one was that at least one of the system of environmental enrichment causes a clear interaction by animals when active, in order to state that piglets welcome wood proposed in form of small logs or briquettes. An analysis to evaluate a preference between the core of veneer

poplar logs and the wood sawdust briquettes did not take place. Thanks to previous experiences, the two kinds of material were considered similar for the animals and were replaced during the test period only for an assessment of their condition at the end of the trial.

The test involved 72 post-weaning piglets divided into 3 pens with hard plastic slatted flooring, as in a typical commercial farm. Only one system of environmental enrichment was installed inside each pen (Fig. 3). The animals were a crossbreed Duroc x Large White. The piglets entered in the pens at the time of mixing after weaning at 28 days of age. Mixing criteria were the same for each group. The animals were fed ad libitum; temperature and light inside the house were automatically regulated.



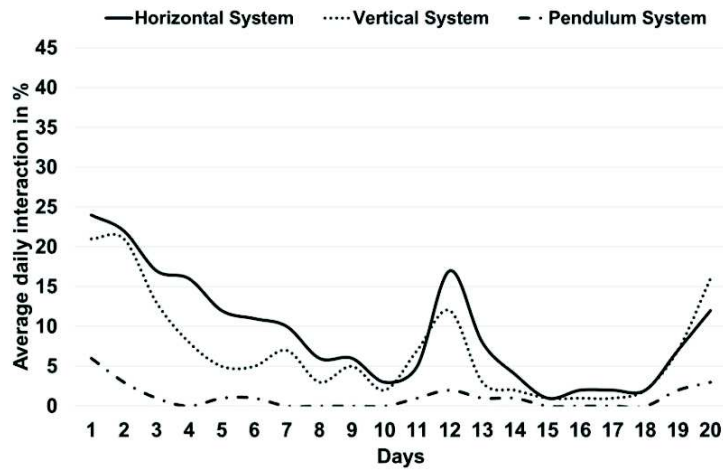
**Figure 3.** Devices placed in experimental pens.

Video recordings were made with infrared CCTV cameras. Three cameras were installed on the roof in order to have a detailed vision of each pen. All the 20 days of the trial were considered for the data analysis examining the hours from 05.00.00 to 17.59.59. The behaviour of the pigs was continuously monitored during the entire period of the trials.

In the count, all animals not sleeping were considered active. Among active animals, the ones touching the piece of wood were considered in interaction with it. The average and maximum number of active piglets, and the average and maximum number of piglets busy with the device were detected per each hour and per each device. These values were put into relationship to compute the average and the maximum hourly level of interaction of the animals. Then the daily averages of the two values were derived per each system. One-way ANOVA was performed to assess difference in the level of piglets interaction generated by different devices. Then, a linear regression analysis was performed to study the relationship between the total number of piglets active and the piglets busy with the most attracting device.

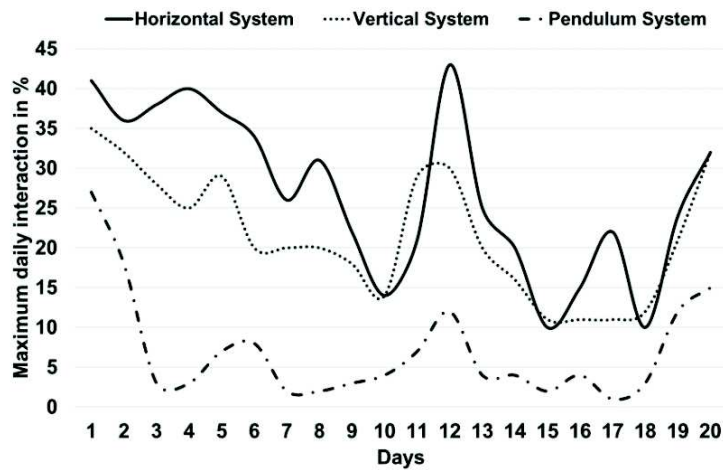
## RESULTS AND DISCUSSION

Different levels of interaction were recorded for the three devices installed in the pens. In Fig. 4 the comparison between the daily average levels of interaction is reported. The horizontal system caught the highest level of interest among animals ( $P < 0.005$ ). Fig. 5 shows a similar trend for the daily maximum levels of interaction. The study confirms the results obtained by Blackshaw et al. (1997), which found that fixed toys may stimulate more play behaviour than free toys if they are held in one position above the pen floor at weaning pig eye level and swing freely.



**Figure 4.** Comparison among systems on average daily interaction.

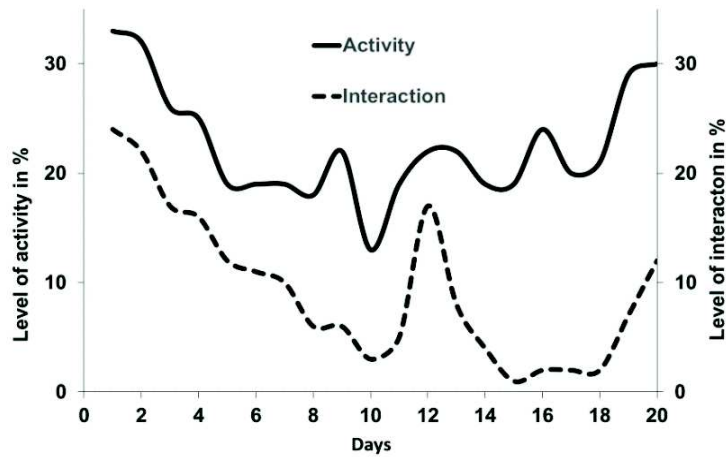
During some days, more than 40% of active animals played with the system at the same time. It happened in the early days after mixing, which are the most critical because in that period the major cases of aggression occur in order to create a hierarchy. However, there are some other peaks of interaction, particularly evident in Fig. 5. The explanation is that, during those days, the pieces of wood were replaced and piglets were disturbed by human intervention, causing an increase of activity on the animals and also a renewed interest towards the clean materials.



**Figure 5.** Comparison among systems on maximum daily interaction.

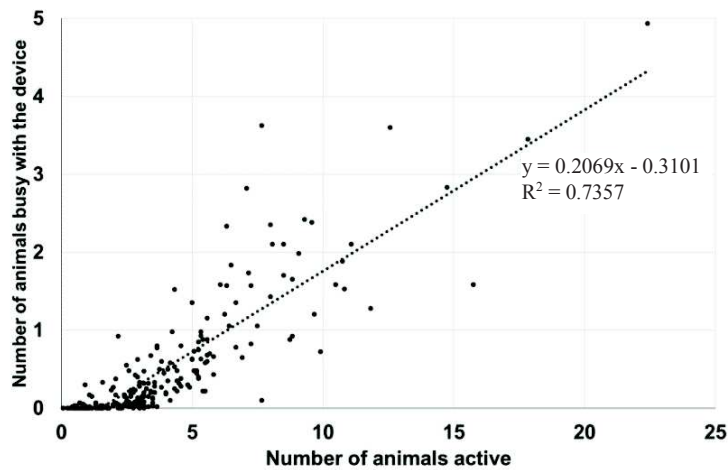
Once established that the device giving the greatest interaction by the piglets was the horizontal one, data related to this system were used to analyse more specifically the correlation between the activity of the animals and the contact with the object. Fig. 6 shows the tendency of interaction in relation to the activity level of the piglets in the pen. The two variables follow a similar trend, most evident in the early days, less in the last

ones. The replacement of the material strengthens the interaction, but after that, there are sharp decreases in the lines, stronger than in the initial phase.

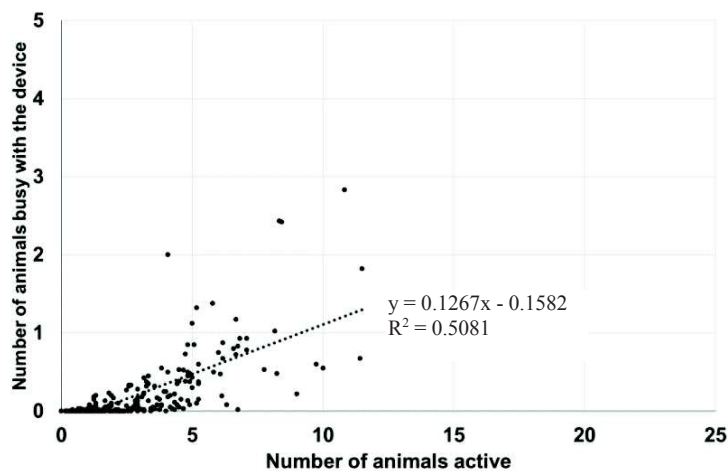


**Figure 6.** Trend of piglets activity and interaction with horizontal system.

To better analyse the relation, the data of the horizontal system were divided into two groups: the first 10 days and the second 10 days. Fig. 7 concerns the first 10 days and shows the number of animals active during the examined period and the average number of animals using the device at the same time, plotted against each other. In Fig. 8, the data chart of the last 10 days is shown.



**Figure 7.** Comparison between hourly average activity and interaction with horizontal system in the first 10 days after weaning.



**Figure 8.** Comparison between hourly average activity and interaction with horizontal system in the last 10 days of weaning phase.

The linear regression lines of the two groups of data are very different. In the first 10 days,  $y = 0.20x$  ( $R^2 = 0.73$ ), which means that in this period on average 20% of the active animals play with the horizontal system and there is a good correlation between the level of activity and the level of interaction. In the second 10 days,  $y = 0.12$  ( $R^2 = 0.50$ ), which means there is a fall to 12% in the average use of the device with a poorer correlation between the activity and the interaction.

As far as the other systems, vertical one showed to be a valuable device of environmental enrichment. Notwithstanding, there were some problems, especially during the first days. The presence of a stationary object in the middle of the pen with a large number of animals moving provoked some injuries. The pendulum system, instead, despite its poor performance could be considered a suitable system, but it needs to be improved in order to generate higher interest in piglets.

A last consideration concerns the difference between the two materials used during the test. In previous experiment with older animals, the wood sawdust pressed briquettes did not survive the first day because pigs ate them. Vice versa, during the trials in the post-weaning phase, the sawdust pressed briquettes proved to be durable as the poplar logs.

In conclusion, the results of the trials confirm the statements of Nowicki et al. (2007b). The possibility of chewing the material, till destruction, makes a device for pigs more attractive, shortening the time of agonistic behaviour and helping to establish the social hierarchy earlier.

## CONCLUSIONS

The study confirms that wood in form of small logs and briquettes can generate an exploratory behaviour in post-weaning piglets. A reasonable level of proper investigation and manipulation activities has reached in the pen with slatted floor. However, the result greatly depends on how the material is proposed.

The horizontal system seems to be the most efficient way to stimulate the willingness to play of the piglets. In spite of this, the exploratory behaviour is decreasing, especially after 10 days, and the trend cannot be changed even replacing the consumed material with a new one.

Further studies can be useful to confirm if wood proposed in such form has a direct impact in reducing aggression after mixing. Besides, it would be interesting to compare pig behaviour and preferences for the device placed in different positions of the pen. In the meantime, the level of interaction reached by these systems can be considered a good indicator of the capacity of the devices to be a suitable way to propose wood as environmental enrichment for post-weaning pigs in farms with slatted flooring.

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