

# THE EFFECT OF BEDDING ON THE BEHAVIOUR AND WELFARE OF PIGS

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**Abstract**

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*Straw bedding provides a number of functions which affect the behaviour and welfare of pigs including comfort, recreation and diet. It has been suggested that the importance of these different functions will vary depending on the life/production stage of the pig. The available literature indicates that all of the above functions are relevant to all the different stages except newly born piglets. The occupational value of straw appears to be highly important. The actual mechanisms by which straw affects the pig's motivation systems are still poorly understood. It is therefore uncertain whether suitable alternatives to bedding exist or even if straw bedding in itself is completely satisfactory. Until satisfactory alternatives are available straw bedding should continue to be recommended in terms of pig behaviour and welfare.*

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**Keywords:** *animal welfare, behaviour, pigs, straw bedding*

## **Introduction**

The use of straw bedding in pig housing has declined with the development of intensive systems which use less space and have slatted or perforated floors which handle the waste as slurry. These changes brought many benefits to the producer but little thought was given to how they would affect the behaviour and welfare of pigs.

Fraser (1975, 1985), Fraser *et al* (1991), categorized three effects of straw on the well-being of pigs; it improves floor comfort; it allows a greater opportunity for recreation and can compensate the lack of bulk in the diet. Fraser (1985) proposed that these functions may have different values for pigs at different ages. For example, dietary bulk will be more important for food-restricted sows than for growing pigs which are fed *ad libitum*. A greater understanding of the effects of straw on the different life-stages of the pig might allow us to be more selective in the use of straw or even find a suitable substitute more compatible with modern housing and manure handling. This study reviews the effects of bedding on the behaviour and welfare of pigs at different stages of production. The study does not make reference to boar accommodation, partly because boars are frequently housed in straw bedded pens and also because very little work has been carried out on them.

It has been suggested that bedding may have a negative effect on welfare in that it can harbour pathogens and increase dust levels. However, there seems to be little scientific evidence to indicate that disease is more prevalent in pigs kept on straw.

### **Comfort**

Straw bedding has properties similar to the kind of substrate a pig would find naturally. It acts as a cushion and so reduces discomfort and injury. The floors of intensive systems are bare and unyielding. They resist rather than absorb the dynamic interplay between the animal and its environment. The inevitable build up of faeces and urine on many concrete floors is partially absorbed by bedding, ensuring a good foothold and reducing contact between these residues and the animal. Bedding also provides thermal comfort and can reduce the temperature requirements of growing pigs by as much as 6°C (Bruce & Clark 1979).

### **Recreation**

Under recreation, Fraser (1985) lists those activities which are primarily associated with foraging for food. Pigs are omnivorous opportunists and have a very well developed ability for exploratory behaviour. Most exploration is directed to objects at floor level which are investigated by sniffing, chewing and rooting. In extensive environments, pigs can spend more than half the daytime foraging and exploring even when their daily dietary requirements are satisfied (Stolba & Wood-Gush 1989). Modern housing systems provide little opportunity for these activities.

### **Diet**

Pigs have developed feeding strategies that deal with a varied, fibrous diet which generally takes a relatively large amount of time to find and assimilate. In modern husbandry systems, sows are usually fed a daily ration which contains little fibre and takes little over 15 minutes to consume. Generally, the amount of food meets the requirements for maintenance but does not necessarily satisfy appetite. The regime is therefore at odds with both the appetitive and consummatory components of the sow's feeding motivation. Growing pigs more often have continuous access to food which satisfies appetite but again takes little time to consume.

### **Pregnant sows**

#### ***Injury, comfort and preference***

Most studies of leg injuries and the infections which cause lameness have focused on floor type (Penny *et al* 1965, Bäckström 1973). Sows are normally confined on bare concrete floors, often part-slatted resulting in a high frequency of lesions, especially when the floor is poorly designed or damaged (Baxter 1984). In the absence of bedding, sows appear to be reluctant to lie down due to a lack of physical comfort (Fraser 1975). When lying, as little as 10-20 per cent of a pig's total body surface area comes into contact with the floor (Baxter 1984). The amount of strain on these areas of the body, especially the bony parts, will obviously be high and increase with body size. Lying preference in sows prior to farrowing is clearly orientated to comfortable surfaces and even more to surfaces which can be manipulated (Arey *et al* 1992).

Sows also prefer earth to concrete floors but preference for straw over woodchips is less clear (van Rooijen 1980, Hutson & Haskell 1990). Bedding is selected not only on comfort criteria but also for foraging activities; the extensive use that sows make of straw as a material to manipulate has been documented in a number of studies (Jensen 1981, Bengtsson *et al* 1983, Jongebreur 1983, Gloor & Leimbacher 1984, Grauvogl 1987).

#### ***Apathetic behaviour and stereotypies***

The combination of close confinement and lack of bedding can lead to the development of apathetic behaviour and stereotypies in sows. Apathetic behaviour is characterized by reduced responsiveness to the environment. The animals are typically less active and spend large amounts of time sitting or standing motionless. Stereotypies include repeated, relatively invariable sequences of movements such as bar-biting, sham-chewing and head-weaving. The occurrence of both apathetic behaviour and stereotypies indicate that welfare is poor (for review see Fraser & Broom 1990).

A number of studies have shown that both apathy (van Putten 1980, Wiepkema *et al* 1983, Broom 1986) and stereotypies (Fraser & Broom 1990, pp 363) are much less frequent in deep-bedding, group-housed sows. Although group-housed sows also have more space and social contact, the provision of bedding makes a significant contribution to improving their environment (Schunke 1980, Vestergaard 1981). Confined sows were less apathetic and performed fewer stereotypies when they were given straw bedding (Fraser 1975), while Terlouw *et al* (1991) found that the provision of more space alone did not reduce stereotypies in gilts.

#### ***Dietary effects***

Diet can also have an effect on stereotypic behaviour. Gilts on a high level of feed (4kg per day) performed less stereotypies than those on a low level (1.25kg per day) (Appleby & Lawrence 1987). The incidence of abnormal behaviours was also shown to be reduced by adding to the diet, un-molassed sugar beet pulp which appears to have unique properties that reduce feed intake (Brouns *et al* 1991). However, the level of stereotypies was not reduced by the addition of chopped straw as dietary bulk (Fraser 1975, Broom & Potter 1984).

#### ***Lactating sows***

##### ***Nest building behaviour and the udder comfort hypothesis***

According to Fraser (1983), pigs are similar to carnivores in that they give birth to their young in specially prepared nests. Detailed descriptions of sow nest building behaviour have been documented in the wild sow *Sus scrofa* (Gundlach 1968, Graves 1984), for feral sows (Kurz & Marchinton 1972) and for domestic sows in semi-natural enclosures (Stolba & Wood-Gush 1984, Jensen 1989). Nests are generally built in sheltered locations and usually comprise a scraped hollow, lined with nest material such as leaves and twigs which is then surrounded by earth walls and branches.

Similar nesting activities have been reported for sows housed in straw pens (Vestergaard & Hansen 1984). Baxter (1982) proposed that the function of the behaviour was to provide comfort for the udder and that motivation to build a nest will be reduced when the sow can lie down and her udder is comfortable. He suggested that the provision of a soft resilient lying substrate might satisfy the sow's requirements and obviate any need to perform nest building. However, more recent work suggests the control mechanisms of nest building are more complex. Motivation to build a nest would appear to have a strong endogenous component (Arey *et al* 1992), which is not reduced by the provision of a pre-formed nest (Arey *et al* 1991). Moreover, it seems that the performance of the activities themselves has a significant role in reducing motivation.

### ***The sow's requirements***

At farrowing, sows are normally confined in crates without bedding. These conditions can lead to acute signs of stress as shown by both the sow's behaviour (Baxter 1982, Schouten 1987) and physiology (Baxter & Petherick 1980, Metz & Oosterlee 1981, Kilgour & Dalton 1984, Vestergaard 1984). Much of the frustration may be caused by the lack of materials to build a nest. If sows are simply given more space, the level of abnormal activity such as bar-biting actually increases (Barczewski 1987). Lammers and de Lange (1986) suggest that these abnormal activities are re-directions of the natural behaviour and indicate serious psychological conflict in the animals.

Outdoor sows will gather enough nest material to completely cover themselves and their piglets (Jensen 1989). Sows kept indoors will remove, on average, 23kg of straw from a dispenser to form a nest (Arey *et al* 1991). Although Hutson (1988) claimed that straw bedding is not important for nest building in sows, operant conditioning techniques have shown that sows are highly motivated to gain access to straw pens prior to farrowing (Arey 1992). Sows prefer a substrate which they can pick up and manipulate with their mouths. If the material such as cloth tassel is fixed, sows will pull and tear at it, but less so if straw is also available (Widowski & Curtis 1990). The performance of nesting behaviour is not diminished by a reduction in the amount of straw available. However, 2.25kg appears to be insufficient for sows to build a satisfactory nest (Arey *et al* 1992).

### ***Dietary requirements***

In general, sows around farrowing are fed generously to meet the piglets' demand for milk and to ensure that subsequent reproductive performance is not impaired. The problem is that sometimes, sows in crates lose their appetite after farrowing (Pflug 1976, Barczewski 1987). This may be due to the stress caused by both the inability to build a nest and the birth process (Arey 1992).

### **Piglets**

Once the sow has farrowed, straw can have beneficial effects for both the sow and her piglets (Edwards & Furniss 1988). Straw can have a calming effect on a few sows which

are prone to cannibalism, making them less likely to attack their own offspring (Sambraus 1976). If the sow is not confined then bedding would seem to improve the chances of the piglets surviving (Fraser & Broom 1990). In farrowing crates, bedding can reduce mortality from 32.6 per cent on a non-insulated concrete floor to 11.6 per cent (Aumaitre & Le Dividich 1984). Mortality, morbidity and injuries can all be reduced by providing bedding (Smith & Mitchell 1976, Vellenga & van Veen 1983, Edwards & Lightfoot 1985).

The type and amount of bedding is critical. Litter mortality was found to be lower for straw bedding than shredded paper (Aumaitre & Le Dividich 1984). On the other hand, too much bedding can lead to problems with overlying and make it difficult for newly born piglets to find the sow's udder.

Bedding in farrowing accommodation is also beneficial to the behavioural development of the piglets. In a sterile environment, oral activities become directed towards other pen-mates and the sow. This leads to an increased restlessness, aggression and incidence of injuries amongst the piglets (Schouten 1991) and damage to the sow (Ladewig *et al* 1984). The provision of bedding can significantly reduce these anomalous activities and lead to better growth rates and subsequent performance (Schouten 1991).

### Growing pigs

#### *Weaning*

At 3-4 weeks of age, piglets are usually taken from their mothers. They are subsequently mixed with other litters and placed in an unfamiliar environment. Weaning is therefore a traumatic event to which the piglets take time to adjust. Piglets weaned into flat-deck cages remain restless for longer whereas those on straw have fewer acclimatization problems and show greater synchronization of behaviour (Schouten 1991). McKinnon *et al* (1989) found that piglets weaned onto straw were more active, spending 25 per cent of their activity in straw directed behaviours.

Having lost their regular source of food, the piglets have to look elsewhere and this frequently leads to belly-nosing and navel-sucking of other pigs (Fraser & Broom 1990). This behaviour can progress to the genitalia resulting in anal massage and urine drinking. The receivers of these behaviours may be chased around the pen and it seems likely that their welfare suffers due to the inability to escape and by the injuries which may result. The provision of straw can significantly reduce these behaviours by as much as half (van Putten & Dammers 1976, Buré 1981, Schouten 1986). The benefit of straw is unlikely to be a dietary one, rather it acts as a distraction (Hansen & Hagelsø 1980).

#### *Injury, comfort and preference*

Most growing pigs are kept in pens which are either fully slatted or part-slatted with a concrete solid area. Piglets weaned on to flat-deck cages, more frequently sit in a dog-like position and are less inclined to rest in the normal lying position than those on straw (Fraser & Broom 1990). Concrete floors cause necrotic lesions to the knees, fetlocks, hocks, elbows and coronets, especially in young pigs (Baxter 1984). On slatted floors,

feet develop cracks which can become infected; this rapidly leads to lameness. The development of adventitious bursitis of the hock joint is also attributable to solid floors without bedding. Bursitis was found to affect 95.5 per cent of pigs reared without straw compared with 3.75 per cent of pigs reared with straw (Smith & Smith 1990).

Preference studies have shown that when active, pigs choose to spend more time in a bedded area of a pen than an unbedded area (Marx & Shuster 1986) but during rest they choose the unbedded areas once the temperature is increased above 25°C (Fraser 1985). This finding does not indicate that comfort is unimportant but rather that the pigs were approaching their upper critical temperature (Bruce & Clarke 1979). Pigs show a strong preference for bedding over non-bedded types of floors. There appears to be little difference in the choice of young pigs for either straw or wood-shavings (Mwanjali *et al* 1982). Earth floors have also been shown to reduce the boredom seen in conventional housing (Buré *et al* 1983, Wood-Gush & Beilharz 1983).

#### *Biting and chewing pen-mates*

As they get older 'bedded' pigs continue to spend approximately 25 per cent of the daytime in straw related activities. More straw is chewed and ingested but this does not appear to reduce intake. Pearce (1993) has shown that over the same period of time, pigs on straw ate 5.5 per cent more feed and grew 7.7 per cent faster than those without straw.

In pens without bedding, the highly motivated oral activities become re-directed towards pen fittings and other pigs (Robertson 1985, McKinnon *et al* 1989). Pigs housed on straw perform less of these activities (massaging, rooting, nibbling and chewing of pen-mates) than those without bedding (van Putten & Dammers 1976, van Putten 1980, Buré 1981, Buré *et al* 1983). Although the effect of straw was confounded with other variables such as stocking rate in some of these studies, similar results were found when these factors were controlled for (Fraser *et al* 1991, Pearce 1993).

The chewing of pen-mates can lead to serious outbreaks of biting which is directed at the ears and flanks and most commonly the tails of other pigs. The wounds attract other pigs so that the behaviour can quickly spread throughout the whole group. Many factors have been associated with tail-biting but the problem is mainly due to barren, overcrowded environments (Arey 1991). Several studies have shown that tail-biting can be significantly reduced by straw (van Putten 1980, Ekesbo 1980, Hansen & Hagelsø 1980, Madsen 1980, Buré 1981, Jacob 1982, Buré *et al* 1983, Etter-Kjelsaas 1986).

#### **Conclusions**

Straw bedding makes a significant contribution to the comfort of pigs at all stages. The observed preference for pigs to lie on unbedded areas most likely indicates that these pigs are too warm; it does not show that bedding *per se* is unimportant. Bedding reduces the physical discomfort and injuries experienced by pigs on conventional solid or slatted floors.

The need for comfort does not appear to be the primary cause of nest building behaviour shown by sows prior to farrowing. It is a complex product of both internal

and external causal factors. Straw bedding allows the performance of this highly motivated behaviour and contributes to the welfare of the piglets.

Pigs have developed foraging strategies that depend on high levels of exploratory behaviour which involve the mouth and snout. Straw bedding not only provides a suitable opportunity for these activities but also stimulates their performance, continuously providing a source of novelty when replenished. Pigs of all ages explore bedded pens by sniffing and rooting and will chew and ingest strands even though the nutritional benefits of straw would seem to be slight. Straw may be an important source of fibre but it does not appear to compensate for the lack of bulk in the diet.

It is straw bedding's occupational value which is perhaps most important. It promotes activity and reduces the abnormal behaviours such as apathy, stereotypies and anti-social activity. These benefits can be seen across the whole age range of pigs. The specific mechanisms by which straw bedding operates on the pigs' various motivational systems are still poorly understood. The questions of whether suitable alternatives to straw exist or whether straw bedding by itself is satisfactory therefore remain unanswered. Until satisfactory alternatives are available, straw bedding should continue to be recommended in terms of pig behaviour and welfare.

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