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Different roughages to organic growing/finishing pigs — Influence on activity behaviour and social interactions

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ABSTRACT

The effect of roughage on pigs' activity behaviour and social interactions was investigated at four observation occasions in this study, which was performed during two years and included two experiments of organic growing/finishing pigs. In experiment 1, 377 pigs were allocated randomly to either a control treatment (C) or one of three treatments with access to additional roughages; hay (H), grass silage (GS) or whole crop barley silage (BS). In experiment 2, 138 pigs were randomly allocated to the C or the GS treatment. Pigs were housed indoors with straw in the lying area and with access to a concrete outdoor run, where H, GS and BS pigs were given roughages *ad libitum* in hedges. Pigs given roughage were staying outdoors significantly more frequently than control pigs ($p=0.031$ in experiment 1 and $p=0.002$ in experiment 2) and were more active ($p=0.034$ and $p=0.006$, respectively). C pigs were rooting in straw more often than GS pigs and tended to root more often than BS pigs, which suggests that pigs with additional roughage are motivated to use it to explore and forage. However, no difference in time spent on eating the different roughages was found. Indoors, the frequency of aggressive behaviour in the lying area was lower for pigs with access to roughage than for pigs in the control treatment in experiment 1 ($p=0.009$) and was lower, though not significantly, in experiment 2 ($p=0.121$). Our results confirm that access to additional roughage in the outdoor area significantly influences the pigs to go outdoors more frequently and to be more active, and reduces the aggressive behaviour among the pigs.

1. Introduction

Pigs in organic production should be able to express their natural behaviour for rooting and grazing. Larger areas and outdoor runs occupy pigs giving them more possibilities to be active. Roughages such as grass (fresh or dried), silage or straw should be offered in unlimited amounts (EC, 1999). According to Swedish standards (KRAV, 2007), high quality hay or silage should be included in the diet. Pigs have a capacity to digest forage fibres in the hindgut (Andersson and Lindberg, 1997) and roughages might, due to high fibre content, be a way to improve the well-being of pigs because they positively affect the development of the micro flora and epithelium in the gut (Fernandez and Danielsen, 2002). Roughages also positively affect pigs by increasing their motivation to explore and forage (Roberts et al., 1993; Vestergaard, 1996). It has been shown that roughage can be included in the total diet up to 18–19% of dry matter without refusals (Carlsson et al., 1999) and that pigs with a live weight of 60 kg or more, are able to consume 10% of the energy from roughage (Jensen and Andersen, 2002). Danielsen et al. (1998) showed that when an amount of feed was replaced with roughage, higher meat content and better feed efficiency but slower growth rate was obtained. All aspects of animal production relate to the animals' behaviour (Broom et al., 2007) and the environment influences the well-being and the behaviour of pigs. Pigs are curious and have a well-developed exploratory behaviour (Wood-Gush and Vestergaard, 1991). Exploring, foraging and rooting behaviours are expressed largely in the pigs' general

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activity and are performed to search for possible locations of food and to gather general information on the surroundings (Studnitz et al., 2007). Inglis and Ferguson (1986) suggested that the animal is motivated to work for information as well as to find food. Pigs that were born and kept in a semi-natural environment (including grass and woodland) spent 20% of the daylight period rooting and 30% grazing (Stolba and Wood-Gush, 1989). Roughage is an important resource in organic production systems, which can influence the pigs' activity pattern and social interactions. By increasing the time spent eating, roughage can occupy the pigs and most likely reduce stress and aggression between individuals. Several studies have shown a reduction in aggressive and harmful behaviours when enrichments such as roughage or straw were supplied (Petersen et al., 1995; Beattie et al., 2000; Persson et al., 2004). The same results were obtained with barley-pea and whole crop silage roughages, which were also concluded to be appropriate rooting substrates for pigs (Olsen, 2001).

The objective of the present study was to evaluate the effects of roughage on organic growing/finishing pigs' activity behaviour and social interactions. The hypothesis was that access to additional roughage in the outdoor area would make the pigs use this area more frequently and change their activity pattern. Further, access to roughage would reduce aggressive behaviour and stress among the pigs.

2. Materials and methods

2.1. Animals and experimental design

A total of 515 organic female and castrated male pigs were included in this two-year field study, comprising two experiments, performed during 2002/03 and 2004/05. Experiment 1 included 377 pigs in three different herds (I, II, III) and experiment 2 included 138 pigs in herd III. Four pens per herd within experiment were included in the study. All pigs were of (Landrace*Yorkshire)*Hampshire breed. The pigs were bought from two organic piglet-producing herds at an average live weight of 33.2 kg (SD 10.7 kg) in experiment 1 and 30.2 kg (mean value) in experiment 2. The pigs in experiment 1 were weighed every second week until slaughter, which occurred at an average live weight of 111.3 kg (SD 7.0 kg). The pigs in experiment 2 were only weighed initially at arrival and had an average carcass weight of 88.7 kg (mean value). Pigs in experiment 1 were according to sex and live weight randomly allocated to either a control treatment (C) or one of three treatments with access to additional roughages; hay (H), grass silage (GS) or whole crop barley silage (BS). Based on the results from experiment 1, experiment 2 was set to observe pigs in the control treatment (C) or the treatment with additional grass silage (GS). All pigs were included in both treatments and changed alternately between the treatments regularly during the growing/finishing period.

2.2. Housing

The two experiments were carried out during the winter period (November–February) when the pigs were housed indoors with access to an outdoor run. The average outdoor temperature was 0.7 °C (min. −10.0° and max. 10.5 °C) in experiment 1 and 5.0 °C (min. −7.1° and max. 11.4 °C) in experiment 2. Pigs in herd I were housed in a barn, which was un-insulated, with 29, 31, 36 and 49 pigs per pen, respectively. Each pen contained a lying area on a deep straw bed and an eating area with water cups and feeding troughs, which allowed all pigs to eat simultaneously. The total indoor area was 1.52 m^2/pig. The pigs had access to a concrete outdoor run without roof, with an area of 1.0 m^2/pig. The openings between the pen and the outdoor run were provided with a transparent plastic curtain and there was a ramp leading down to the concrete. The deep straw bed was cleaned once before arrival of new piglets and provided with a large bale of straw once a week during the growing/finishing period and the outdoor run was cleaned once a week. Pigs in herd II were housed in an insulated rebuilt stable with 22, 22, 32, and 32 pigs in each pen, respectively. Pigs in herd III were housed in an un-insulated barn and each pen enclosed 31 pigs in experiment 1 and 32, 35, 35 and 36 pigs, respectively in experiment 2. The pens in herd II and III consisted of a lying area with slatted floor. The lying area was provided with cut straw (herd II) and a small bale of straw (herd III) everyday, and the pens were cleaned daily. Each pen had an eating area with feeding troughs to allow all pigs to eat simultaneously. The total indoor area was not less than 1.59 m^2/pig. The pens also allowed admittance to a concrete outdoor run without roof and the area was not less than 1.03 m^2/pig. The openings between the pen and the outdoor run were provided with a transparent plastic curtain and in herd II and III there was a step leading down to the concrete.

2.3. Diets and feeding

All pigs were fed liquid diets based on organic raw materials (cereal grains and protein concentrates). In experiment 1 the diets were complemented with cream and whey (herd I) or starch-by products (herds II and III). Correspondingly, the diets in experiment 2 were complemented with distiller's grain. The pigs were fed three times daily according to the standard feeding regime for growing/finishing pigs in Sweden (Andersson et al., 1997). All pigs received straw in the lying area and H, GS and BS pigs were given additional roughages *ad libitum* in feeding hedges in the outdoor area. Roughage was replenished every morning and if needed in the afternoon.

2.4. Behaviour observations

Behaviour observations were performed in all pens at four occasions continuously; at arrival and later every four weeks throughout the growing/finishing period. In experiment 1, two observers, one in herd I and one in herd II and III, recorded the observations, whereas in experiment 2, one observer recorded all observations. The observers were standing outside the pen viewing both indoor and outdoor areas and the observation did not start until the pigs were accustomed and paid no attention to the observer. In experiment 1, each observation occasion lasted two days and the pigs were observed twice daily, one session at 9.00 and one at 13.00. In experiment 2, all pigs changed alternately