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Feeding strategy in group-housed growing pigs of four different breeds

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ABSTRACT

Feeding strategy was studied in 205 growing boars in two blocks of 116 and 89 pigs of four breeds (Large White, Landrace, Duroc and Pietrain) respectively. Pigs were housed in groups of 12–14 individuals, with a single breed in each group. Feeding patterns were recorded with a computerized feed intake recording system. An individual meal criterion was applied to each pig to group visits into meals. Pigs were weighed every 10 days throughout the study to calculate average daily gain. For the four breeds, the number of meals or visits per day was negatively correlated with sizes of meals or visits ($-0.88 \leq r \leq -0.74$) and with duration of meals or visits ($-0.86 \leq r \leq -0.69$); size of meals or visits were positively correlated with duration of meals or visits ($0.79 \leq r \leq 0.90$). Total time feeding per day was negatively correlated with rate of feed intake ($-0.79 \leq r \leq -0.67$). Based on these results, four types of feeding strategies were described: 'meal eater', 'nibbler', 'fast eater' and 'slow eater'. The feeding parameters most highly correlated with average daily gain were feed intake per day ($0.79 \leq r \leq 0.93$), feed intake per visit or per meal ($0.28 \leq r \leq 0.54$) and rate of feed intake ($0.38 \leq r \leq 0.43$). Pigs showing 'meal eater and fast eater' strategies may have some productivity advantages. Breed had a significant effect on many feeding parameters: visits and meals were more frequent in Large White and Pietrain pigs than in Duroc and Landrace pigs, whereas pigs of the last two breeds had a higher size of visits than pigs of the other two breeds. Landrace and Large White pigs spent less total time feeding per day than Pietrain and Duroc pigs; and rate of feed intake was higher in Landrace and Large White pigs compared to Pietrain and Duroc animals. This suggests a 'specific feeding strategy' for each breed: Duroc pigs were 'meal and slow eaters', Landrace pigs were 'meal and fast eaters'; Large White pigs were 'nibblers and fast eaters', and Pietrain pigs were 'nibblers and slow eaters'. Changes in light intensity not only affected feeding activity, but also altered the feeding strategy: from 7 to 14 h pigs behaved as a 'nibblers and slow eaters'; from 14 to 20 h pigs showed a 'meal eater and fast eater' strategy, and from 20 to 7 h animals followed a 'meal eater and slow eater' strategy.

1. Introduction

Feeding behaviour of pigs has an important effect on production, as there is a positive high correlation between daily feed intake and growth (e.g., $r = 0.85$ in Labroue et al., 1997). Daily feed intake is related to other feeding parameters and, for example, Hyun et al. (1997) found a positive high correlation ($r = 0.73$) between daily feed intake and meal size. In fact, it is assumed that pigs have a desired level of daily feed intake that drives many other aspects of their feeding behaviour (Nielsen, 1999).

Feeding behaviour in growing pigs shows a large individual variability (Labroue et al., 1994), leading to different

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feeding strategies; i.e., diverse ways through which pigs can express feeding behaviour in order to defend their desired level of daily intake. For example, Labroue et al. (1994) suggested the existence of a range of eating patterns varying from *meal eaters* (few long meals every day) to *nibblers* (many short meals every day).

Variability in feeding behaviour is also observed between breeds; for example, De Haer and De Vries (1993a) concluded that, with the exception of daily feed intake, a significant effect of breed (Great Yorkshire versus Dutch Landrace) was found for all aspects of feeding behaviour. However, there are still very few studies on breed differences in feeding behaviour, and most of them have looked at Large White and Landrace only. The feeding behaviour of growing pigs is also under the influence of social (e.g., group size) and environmental factors (e.g., seasonal variations in length of daytime period), and a genotype × environment interaction cannot be ruled out (Labroue et al., 1999). These factors may cause pigs to change their feeding strategy: for example, Nielsen et al. (1995a) concluded that when the group size reaches a certain level, an additional change in feeding behaviour is necessary to achieve the desired level of feed intake. The interaction between social factors and physiological mechanisms that regulate feeding behaviour can be understood using prandial correlations, i.e., the correlation between the time before a given meal and the size of that meal (pre-prandial correlation) and the correlation between present meal size and the time to the next meal (post-prandial correlation). For example, Young and Lawrence (1994) suggested that in a given social environment, animals with significant positive pre-prandial correlations are regulating feed intake by a satiety mechanism, whilst those with significant positive post-prandial correlations use a hunger mechanism. They concluded that the type of prandial correlations may be a measure of the behavioural control that pigs have over their feeding patterns where social competition interferes with feeder access. However, prandial correlations in pigs are not widely investigated.

The main objective of this study was to investigate the feeding strategy in group-housed growing pigs of four different breeds (Landrace, Large White, Duroc and Pietrain) with a computerized feed intake recording (CFIR) system.

2. Materials and methods

2.1. Animals, housing and diets

The experiments were carried out in the Pig Testing Centre (IRTA, Monells, Spain) and consisted of two blocks of pigs. In the first block (in autumn): from 6 November to 5 January, 116 boars of four breeds were analysed: 34 Large White, 36 Landrace, 24 Duroc and 22 Pietrain. Animals were housed in 10 pens of 12 pigs each with a single breed in each pen. All pigs arrived at the experimental facilities on the same day with a body weight of 27.60 ± 3.41 kg (mean ± SD) and 65.97 ± 1.99 days of age (mean ± SD). In the second block (in spring): from 11 March to 10 May, 89 boars were analysed: 35 Large White, 24 Landrace, 23 Duroc and 7 Pietrain, and the animals were housed in 8 pens of 12–14 pigs each with a single breed in each pen. The animals arrived at the experimental facilities on the same day with a body weight of 31.63 ± 4.58 kg (mean ± SD) and 73.23 ± 2.42 days of age (mean ± SD).

Pigs were offered standard pelleted feed *ad libitum* (117 g crude protein, 14 MJ digestible energy, 38 g crude fibre, 880 g dry matter, 62 g ash and 72 g crude fat per kg). Each pen (12.85 m^2) had half-slatted floor and one drinking bowl. Space allowance was 1.07 m^2 per pig in the first block and 1.07–0.92 m^2 per pig in the second block. The light regime was natural, with seasonal variations: in autumn block (sunrise: 07:28–08:17 h; sunset: 17:37–17:31 h); in spring block (sunrise: 07:07–06:33 h; sunset: 18:51–20:57 h). Ventilation and temperature (between 18 and 30 °C) were mechanically controlled: two fans worked continually and they increased their power when the temperature reached 30 °C. In winter, the facilities were heated when the temperature was below 18 °C.

Eighteen pigs were removed from the analyse due to illness: four in the first block (two Large White and two Pietrain; total number of animals analysed: 120 − 4 = 116 boars) and 14 in the second block (two Duroc, four Landrace, three Large White and five Pietrain; total number of animals analysed: 103 − 14 = 89 boars).

2.2. Data recording

Each pen was equipped with a single IVOG® feeding station (Insetec B.V., Marknesse, The Netherlands) that consisted of a single-space food hopper, a trough which was weighed continuously and an electronic identification system that was activated by ear transponders as the animal entered the station. The feeding station was connected to a computer through a load cell. Time and weight of food at the beginning and at the end of each visit were recorded automatically, together with the animal identification number. Food consumption per visit vas calculated as the difference between the amounts recorded just before and after the visit with an accuracy of 10 g. Pigs had 24 h access to the CFIR systems and the entrance to the hopper was always open. In order to avoid two pigs entering the station at the same time the size of the entrance was adjusted (between 20 and 35 cm) to the body size of pigs.

2.3. Data processing

The first 11 days were considered as an habituation period to the CFIR systems and were not statistically analysed. From then on, the following 50 days were monitored in both blocks. Non-feeding visits were not included in the feeding patterns. Visits to the feeder were grouped into meals according to the meal criterion of each pig (*individual meal criterion*). The meal criterion was obtained using the log survivorship curve technique (Metz, 1975). The survivorship curve was adjusted partly with a curve (polynomial of order 2) and partly with a linear function. Data were processed using Microsoft Excel (v. 6.0; Microsoft Corporation, 1995). The average meal criterion (*overall meal criterion*) of all pigs was 30.01 s. In a preliminary study (Fernández, 2001) it was observed that feeding parameters obtained by applying an overall meal criterion to all animals were statistically different from those