Short communication

The effect of gilts’ age on inactivity in a behavioural test

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Abstract

The present study investigated whether gilts’ reactivity in an arena test, developed for selecting prepubertal gilts for reproduction, changed with age. One hundred and twenty gilts were used in the study of which 60 were tested at 3 months of age and re-tested at 4.5 months of age and 60 were tested only at 4.5 months of age. During the 3 min arena test the duration of inactivity was recorded by direct observation.

The results from the present study showed that gilts were less inactive, when exposed to the arena test at 4.5 months compared to 3 months (57 ± 9 s versus 92 ± 10 s; \( P < 0.05 \)). This change in inactivity was due to an effect of age and not to an adaptation to the test situation since no difference was found between the gilts in the group re-tested at 4.5 months and the gilts in the control group, which had never been exposed to the arena test before (57 ± 9 s versus 45 ± 9 s; NS). The measure of inactivity shows some consistency across time (\( P = 0.052 \)). Thus if a selection of prepubertal gilts is to be made, based on the arena test, the results of the present study show that the selection should be carried out within gilts tested at the same age.

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1. Introduction

By screening for maternal qualities before puberty, it would be possible to detect and exclude gilts with a potentially high occurrence of risky behaviour with respect to early piglet mortality,
and solely use potentially good mothers for reproduction. Thodberg et al. (1999) showed, that gilts’ reactivity in different stressful test situations at 4–4.5 months of age could predict maternal quality to some extent. In order to perform such a test under practical conditions it would be more efficient, though, if gilts of a wide age span could be subjected to the test. However, a non-detected change in reactivity with age entails the risk of selecting “sub-optimal” gilts for reproduction. If gilts are to be tested at different ages, consistency of the behaviour trait used for selecting potentially good from potentially poor mothers has to be demonstrated. The present study aimed at investigating whether gilts’ reactivity in an arena test changes with age.

2. Materials and methods

2.1. Animals and housing

One hundred and twenty crossbred Danish Landrace/Yorkshire/Duroc gilts were subjected to an arena test. Throughout the experimental period they were housed in pens with 10 individuals, including castrates not used for the study. The groups were formed at approximately 12 weeks of age. The age of individual gilts differed with maximum 2 weeks. The pens measured 5.0 m × 1.6 m, with one-third slatted floor. The pigs were fed ad libitum and had free access to water. During the study the temperature inside the barn was kept at 20 °C. Artificial light was on between 0700 and 1530 h.

2.2. Test apparatus and handling

The arena measured 1.0 m × 2.0 m and the walls were 1.2 m high. Prior to testing an arena was placed inside the pen by an assisting person. Approximately 80% of the floor in the arena was slatted. A shutter was built into one of the long sides of the arena. In the corner farthest away from the shutter, a stool was placed on which an unfamiliar person was sitting during the arena test. The unfamiliar person observed the behaviour of the gilt and recorded this on a hand held computer (copyright 1995 Psion PLC). The gilts were tested individually, and within each pen the test order was randomized between gilts. The pen mates stayed inside the pen during testing. Time used for handling the gilts before the test started was registered. Throughout the study three different people acted as the observer. He or she wore orange coveralls, whereas the assistant wore neutral coloured clothes similar to the clothes used by the staff in the barn. During the test the unfamiliar person was sitting holding the small computer with both hands in the lap. The gilts were given a gentle but firm push if they became violent towards the observer.

The arena test lasted 180 s. By continuous sampling the observer recorded the total duration of the gilt being inactive. The behaviour of the gilts was recorded as ‘inactive’ if they immobilized, i.e. remained completely motionless with stiffened muscles and ears erect, perhaps trembling, or if they were standing without doing anything but perhaps moving the head or turning the body slightly.

2.3. Test design and procedure

The 120 gilts were randomly and evenly divided into a test and a control group. Gilts from the control group were not housed together with gilts from the test group. The 60 gilts in the test group were tested at approximately 3 months of age and re-tested 1.5 months later, i.e. at approximately 4.5 months of age. The 60 gilts in the control group were tested only at 4.5 months of age. At 3 months all gilts were tested within the same day. At 4.5 months of age testing was carried out on 2 days with 1 day in between. On each day one half of the gilts tested belonged to the test group and the other half to the control group.

In half of the gilts a forced human approach test was carried out either before or after the arena test as part of a supplementary study.
2.4. Statistical analysis

One of the test pigs turned out to be a castrate and two other test gilts died due to disease before the test repetition at 4.5 months of age. Therefore, the final analysis was carried out on 57 test and 60 control gilts. The Mixed procedure of the SAS\textsuperscript{®} statistical programme was used for analysis.

The effect of age on the duration of inactivity during the arena test was analysed by variance component analysis of repeated measures (Littell et al., 1996) taking differences between test individuals into consideration. The model included age at testing, handling time, observer identity, test number (i.e. the number that each gilts were tested among the total number of test individuals within the pen), and test order as fixed effects. As a random effect the model included the interaction between pen and age at testing. A heterogeneous autoregressive covariance-structure of first order (ARH(1)) was used to model the correlation between repeated measurements on test individuals. The repeated measures were specified as the two measures of duration of inactivity, common to each individual, obtained at 3 and 4.5 months of age.

Comparison of the duration of inactivity between the test gilts and the control gilts at 4.5 months was made by variance component analysis (Littell et al., 1996). Durations of inactivity were transformed by square root in order to meet the assumption of normal distribution. The model included type of individual (i.e. test gilt or control gilt), day of testing, handling time, observer identity, test number, and test order as fixed effects. Pen was included in the model as a random effect. In both analyses Sattherthwaites approximation was used to calculate the denominator degrees of freedom (Littell et al., 1996). This can result in decimal degrees of freedom that are not integers.

3. Results

The duration of inactivity was lower at 4.5 months of age compared to 3 months (57 ± 9 s versus 92 ± 10 s; $F_{1,18.9} = 5.31; P < 0.05$). No effect of handling time, observer identity, test

![Graph](image-url)
number or test order on the duration of inactivity at the two ages was found. The correlation between the repeated measures of inactivity was 0.28 (±0.14 S.E.; z = 1.94; P = 0.052).

No difference in the duration of inactivity between the test group at 4.5 months (i.e., the retested group) and the control group was found (57 ± 9 s versus 45 ± 9 s; F_{1,8.78} = 1.16; NS). Additionally, there was no effect of either day of testing, handling time, observer identity, test number, or test order on the duration of inactivity in the two groups.

Large between individual variations in inactivity were found. The duration of inactivity within the arena test varied between test gilts from 0 to 174 s at 3 months of age and 0–132 s at 4.5 months. The overall shape of the frequency distribution of duration of inactivity changed from 3 to 4.5 months as seen in Fig. 1a. In Fig. 1b the distribution of duration of inactivity of the 57 retested gilts and the 60 naïve control gilts at 4.5 of months is shown. The distribution for the test gilts at 4.5 months resembles the distribution for the naïve control gilts, corresponding to the similar durations of inactivity in the test and the control group at 4.5 months.

4. Discussion

The results from the present study showed an overall difference in the duration of inactive behaviour at the two test ages. The gilts were less inactive when exposed to the arena test at 4.5 months compared to 3 months. This change in inactivity was due to an effect of age and not to an adaptation to the test situation since no difference was found between the gilts in the group retested at 4.5 months and the gilts in the control group, which had never been exposed to the arena test before. The frequency distribution of the duration of inactivity changed between the two tests performed at 3 and 4.5 months of age. At 4.5 months the major proportion of the gilts was in the lower part of the time interval scale, while it was in the middle part of the time interval scale at 3 months.

Numerous studies have been done on inter-age response consistency in pigs, and while some have revealed repeatability in behavioural responses (Hessing et al., 1994; Jensen et al., 1995; Spoolder et al., 1996; van Erp-van der Kooij et al., 2002) others have not been able to show any consistency (Ruis et al., 2000).

In a study of coping styles in female pigs Janczak et al. (2003) subjected pigs at 8 and 24 weeks of age to a novel-object, a resident intruder, and a voluntary human approach test. Among other behavioural measures they registered the duration of standing in each of the three tests, which is highly comparable to the measure of inactivity used in the present study. Janczak et al. (2003) found significant correlations between the duration of standing for all of the tests, and the inter-age correlation coefficients of 0.28–0.30 resemble the correlation found in the present study. Furthermore, they found a significant decrease in the duration of standing in older animals. Thus, the results of the present study resemble to a large extent the findings of Janczak et al. (2003) and suggest that the decrease in inactivity found by Janczak et al. (2003) is due to an age effect and not adaptation to the test situation.

The reduction in inactivity with increasing age will have an effect on the practical application of selection of gilts for reproduction, based on an inactive behavioural response. However, since the gilts became less inactive with increasing age, a selection based on the measure of inactivity needs to be carried out among gilts tested at the same age. Otherwise the age of the gilt at testing will affect the ranking according to inactivity.

Furthermore, the data analysis showed that the test result is unaffected by the identity of the observer which makes the selection method more robust if it is to be implemented in large scale since it is likely that different caretakers will test the gilts. The robustness relative to observer is
probably due to the broad definition of inactivity in this experiment where inactivity includes both freezing and standing. The underlying motivation for being inactive in the arena test can both be fearfulness (if the pig is freezing/immobilizing) and indifference/apathy.

The rather weak correlation between repeated measures has however consequences for the selection of gilts based on duration of inactivity since the separation between pigs in the two extremes and the remaining individuals is less good compared to when the correlation is higher. However, a very high correlation, which in most cases will be difficult to find, is required if the same individuals should rank highest and lowest, respectively (i.e. be most and least inactive) at both ages. In an ongoing study we test more than 2000 gilts in the arena test and estimate the correlation to peri-parturient behaviour and early piglet mortality, in order to calculate whether prepubertal testing is worthwhile, also taking into account the conclusions of the present study.

In conclusion the results from this study show that the measure of inactivity has some consistency across time, but it is not possible to make a direct comparison between gilts tested at 3 and at 4.5 months, because of the systematic difference in the duration of inactivity between the two ages. However the arena test can be performed on gilts at different ages to separate gilts into high and low responders as long as the selection is performed amongst gilts of the same age.

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References