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Emotionality in growing pigs: Is the open field a valid test?

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ABSTRACT

The ability to assess emotionality is important within animal welfare research. Yet, for farm animals, few tests of emotionality have been well validated. Here we investigated the construct validity of behavioural measures of pig emotionality in an open-field test by manipulating the experiences of pigs in three ways. In Experiment One (pharmacological manipulation), pigs pre-treated with Azaperone, a drug used to reduce stress in commercial pigs, were more active, spent more time exploring and vocalised less than control pigs. In Experiment Two (social manipulation), pigs that experienced the open-field arena with a familiar companion were also more exploratory, spent less time behaviourally idle, and were less vocal than controls although to a lesser degree than in Experiment One. In Experiment Three (novelty manipulation), pigs experiencing the open field for a second time were less active, explored less and vocalised less than they had done in the first exposure to the arena. A principal component analysis was conducted on data from all three trials. The first two components could be interpreted as relating to the form (cautious to exploratory) and magnitude (low to high arousal) of the emotional response to open-field testing. Based on these dimensions, in Experiment One, Azaperone pigs appeared to be less fearful than saline-treated controls. However, in Experiment Two, exposure to the arena with a conspecific did not affect the first two dimensions but did affect a third behavioural dimension, relating to oro-nasal exploration of the arena floor. In Experiment Three, repeat exposure altered the form but not the magnitude of emotional response: pigs were less exploratory in the second test. In conclusion, behavioural measures taken from pigs in an open-field test are sensitive to manipulations of their prior experience in a manner that suggests they reflect underlying emotionality. Behavioural measures taken during open-field exposure can be useful for making assessments of both pig emotionality and of their welfare.

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1. Introduction

On commercial farms, pigs may be exposed to a range of potentially aversive experiences, such as poor handling [1], social stress from mixing aggression and social instability [2,3], various environmental challenges (e.g. elevated ammonia, noise [4]) and barren or crowded housing conditions [5]. These experiences could interact with individual genotype and early life experience to create chronic negative states of emotionality such as fear, anxiety or depression, which have implications for welfare. As such, the ability to accurately assess and interpret emotionality in pigs is important.

Although the open-field test is widely used to assess pig emotionality, Forkman et al. [6] concluded that there was insufficient evidence to back its validity as a test of fear in pigs. This is partly because, in addition to the variety of experimental designs and methodologies used, there is no clear consensus on what behavioural measures are most valuable for pig open field testing. Difficulties can also arise with the interpretation of pig open-field behaviour because a measured behaviour may reflect a component of emotionality such as fear or anxiety *per se* or something else such as exploration or activity. Indeed, a variety of underlying factors, such as fear of novelty [7], exploration [5], social reinstatement [8], and general activity level [9] may affect a pig's behaviour in the open field and some separation of these possible contributory factors is necessary for proper interpretation.

One common method of validation is to assess the impact of anxiolytic drugs on behavioural parameters. In one such study, Diazepam had no effect on pig activity (lines crossed) or number of entries into the centre of an open field [10]. However, parameters commonly used in rodent fear studies [11] may not be relevant to pigs. For example, the basis for the use of centre or periphery time as a measure of fear in the open-field is a behavioural strategy used by rodents to avoid predation in open spaces [11]. In order to capture specific aspects of pig open-field emotionality, a broader range of behaviours need to be measured.

In the present study, we tested the validity of the open-field in 6- week-old pigs using three different approaches. Firstly, we used Azaperone, a butyrophenone neuroleptic drug currently licenced for

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pigs (to prevent aggression and stress, e.g. [12]), as a pharmacological manipulation of emotionality. Secondly, we manipulated the social isolation component of the open field by observing pigs with or without a familiar companion (e.g. [8]). Finally, we manipulated the novelty component of the test by observing the impact of repeat test exposure on pig behaviour (e.g. [8]). We hypothesised, that these manipulations of test experience would alter pig emotional state and that behavioural measures in the open field might reflect underlying pig emotionality. We predicted that, compared to appropriate controls, pigs would be less fearful of the open-field when pre-treated with Azaperone, when tested in a pair, or upon their second exposure to the test.

2. Materials and methods

All experimental work was carried out under UK Home Office licence, following ethical approval by the Animal Experiments Committee at SAC.

2.1. Description of open-field arena and basic testing procedure

The open-field arena (Fig. 1) measured 1.84 m × 1.89 m and had 0.90 m high solid walls. In it were placed two unfamiliar objects, an orange ball (circumference = 65 cm) and a feeder (21.5 cm × 9.5 cm × 9.0 cm: different size and design from the one provided in the home pen) containing 150 g of the standard home pen feed. The presence of the two objects was intended to provide the pigs with an outlet for a broader range of behavioural expression. The arena was washed down with water between tests to reduce odour from the pig in the preceding test. For the open-field testing, each pig was picked up and carried to a different room where they were unable to hear other pigs. The pig was placed in the open field arena at the start point in one corner and the experimenters immediately left the room.

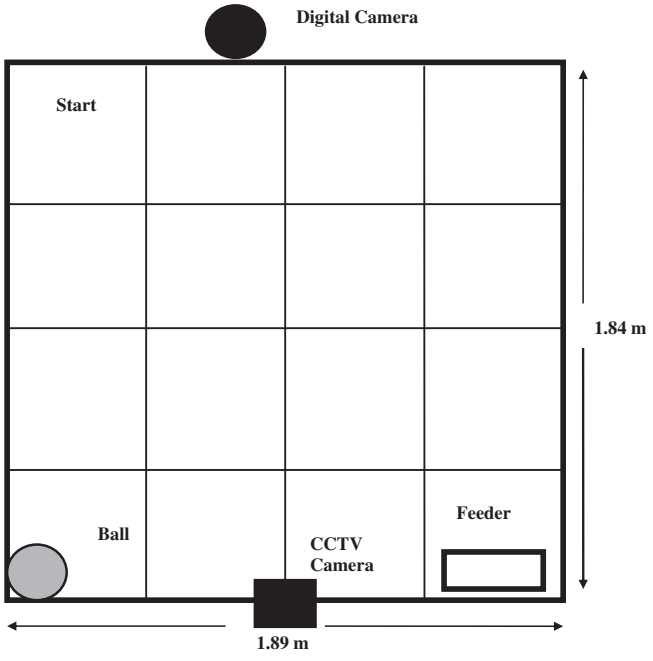

Fig. 1. Schematic diagram of the open field arena dimensions. The pig was placed at the corner start point and was observed for 10 min. For the purpose of analysis, the arena was divided into 16 equal squares.

2.2. Experiment 1: Open field with and without Azaperone

In Experiment 1, the subjects were twenty-four 5–6 week-old Large White × Landrace pigs (13 males, 11 females). Eight pigs were tested from each of three litters. Each of the litters was split at weaning (4 weeks old) into groups of four to six (two pens housing each litter). Housing fewer pigs in each pen (and balancing for test order) was intended to minimise disturbance (by entering the pen) to pigs, especially those drug-treated, while open field testing. Four pigs were tested from each of six straw bedded pens (2.85 m × 1.85 m). Pigs on a light: dark schedule of 12 h:12 h fed ad libitum on a dry commercial diet appropriate for their age.

Each pig was observed twice for 10 min in a cross-over design, once with 1 mg/kg Azaperone (A) (Stresnil®: Janssen Animal Health LTD) and once with an equivalent volume of saline (S). The first and second tests were three days apart and pigs were tested in the same order (balanced across sex, pen, litter, and treatment condition). Open field testing was carried out between 11:30 and 16:00 each day. One experimenter restrained the pig while the other gave a standardised injection intramuscularly to the pig in the home pen. The side of the neck in which the injection was made was balanced across tests, and pigs received a similar amount of handling between tests. Half of the pigs from each treatment (n = 12) were observed immediately after they were injected (injection time: T0), and half (n = 12) were observed 20 min after injection (injection time: T20). Onset of Azaperone is usually straightforward in pigs but if pigs are disturbed (e.g. by handling) within the first 20-min post injection the drug can cause them to behave unpredictably [13,14]. Consequently, T20-pigs were returned to their littermates in the home pen for 20 min before being exposed to the arena.

2.3. Experiment 2. Open field with and without companion

In Experiment 2, the subjects were twenty 5–6 week-old (10 males: 10 females) Large White × Landrace pigs from three litters. Eight pigs were tested from one litter and six pigs from each of two litters. The three litter groups were split at weaning into six pens, each housing four to six littermates. Housing and husbandry, pre- and post-weaning, closely replicated the conditions described in Experiment 1. Half of the pigs were tested in an open field alone (AL: n = 10) and half were tested in pairs (P: n = 10). Sibling pen mates (n = 10) were used as companions for pigs allocated to the paired treatments. Pairs were balanced for sex and weight. Companion pigs were given two 15-minute exposures to the open-field either one or two days prior to testing. Companions were used once and the companion from each pair was placed into the arena first on each occasion. The behaviour of the companion was not formally scored.

2.4. Experiment 3: Open field twice

In Experiment 3, the subjects were twelve 5–6-week-old (6 males: 6 females) Large White × Pietrain pigs from four litters. Four pigs were tested from one litter, three pigs from each of two litters, and two pigs from a single litter. Pigs housed in their litter groups throughout the period of testing were tested twice over two consecutive days. Test order (balanced for sex, weight and litter) was the same for both tests.

2.5. Behavioural observations

Behavioural observations were recorded from a camera mounted above the arena using GeoVision Digital Surveillance System© (ezCCTV Ltd, Herts, UK). Vocalisations were separately recorded from a digital camera positioned at the end of the arena (Fig. 1). Noldus Observer 5.0 (Wageningen, The Netherlands) was used for behavioural analysis. Locomotor activity was scored as the number of times the pig entered (midpoint of head between the ears) one of 16

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