Emotions after victory or defeat assessed through qualitative behavioural assessment, skin lesions and blood parameters in pigs

Irene Camerlink*, Mieke Peijnenburg, Françoise Wemelsfelder, Simon P. Turner

Animal Behaviour & Welfare, Animal and Veterinary Sciences Research Group, Scotland's Rural College (SRUC), West Mains Road, Edinburgh, EH9 3JG, UK

A B S T R A C T

Aggression between pigs causes injuries and production losses and is a long standing animal welfare issue. Although the physiological impact of aggression has been well described, little is known about the emotional experience of aggressive interactions. Our aim was to investigate the emotional expression of winners and losers after a fight and how this relates to costs of fighting. Emotions were studied through use of Qualitative Behavioural Assessment (QBA), a method where participants qualitatively assess the emotional expression of animals seen live or on video. Eighteen pig farmers watched 28 short video clips of pigs which had just won (n = 14) or lost (n = 14) a fight. Farmers rated the pigs' emotions based on a pre-existing list with 21 descriptors of emotions, while being unaware of the contest outcome (winner/loser). Scores were analysed by a Principal Component Analysis (PCA), which resulted in two factors combining the 21 descriptors into four expressive quadrants. Factor 1 ranged from relaxed/content to tense/frustrated, thereby describing valence (explaining 43% of total variance), and factor 2 ranged from active/lively to listless/indifferent, describing arousal (explaining 16%). Winners (W) and losers (L) did not significantly differ in their expression of valence (W -0.19 ± -0.20; L 0.16 ± 0.17; $P = 0.16$) or arousal separately (W -0.07 ± 0.22; L 0.06 ± 0.18; $P = 0.51$), but did in the valence-arousal interaction ($P = 0.02$). In winners a high valence related to low arousal whereas in losers high valence related to high arousal. In addition, winners were observed as more negatively affected than losers by a high number of skin lesions ($P < 0.01$). QBA scores significantly correlated with skin lesions (skin lesions positively correlated with 12 descriptive QBA terms reflecting impaired welfare), blood lactate (curious $r = -0.41$; lively $r = -0.44$; playful $r = -0.40$; positively occupied $r = -0.39$), blood glucose (distressed $r = 0.40$; fearful $r = 0.39$; playful $r = -0.38$) and the contest duration (sociable $r = -0.39$) (all $P < 0.05$). This shows that skin lesions not only reflect physical injury but can also be associated with a negative emotional state, which adds value to their use as a welfare assessment tool. The use of QBA in this study sheds light on the complex ways in which animals emotionally perceive aggression and physical injury. Further studies of this kind will enable better understanding of the true welfare impact of aggressive interactions.

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1. Introduction

Aggression between unfamiliar pigs is a longstanding animal welfare issue in commercial farming. Farm management often requires regrouping pigs into new social groups, which causes intense aggression between the pigs as they re-establish dominance hierarchies (Meese and Ewbank, 1973). As a consequence pigs receive skin lesions, are at greater risk of other injuries such as lameness, and may show a depression in productivity, reproduction, and immunocompetence (De Groot et al., 2001;

Marchant-Forde and Marchant-Forde, 2005). The intensity and frequency of fighting varies greatly between individuals (D'Eath, 2002; D'Eath and Lawrence, 2004). The majority of the population proactively engages in repeated conflicts, which shows that pigs are highly motivated to fight regardless of previous fight outcomes or number of injuries (Desire et al., 2015). Despite the detailed knowledge on the physiological consequences of aggression, such as elevated cortisol and impaired immunity (De Groot et al., 2001), little is known about how pigs perceive aggression. Otten et al. (2002) suggested, based on stress physiology, that high ranked pigs which were defeated would show more emotional distress and fear compared to successful pigs. Yet, it is unknown how pigs perceive victory or defeat per se or how victory is perceived when it has been achieved at the cost of many injuries.

Understanding animals' emotions is an important goal in animal science (Mendl et al., 2010) to, amongst others, better assess animal welfare and to bring affective neurosciences into context (Murphy et al., 2014). Animal emotion has also been acknowledged in the Welfare Quality® protocol. In this animal welfare assessment tool the animals' emotions are included through use of Qualitative Behavioural Assessment (QBA). QBA is described as a 'whole animal' assessment approach that characterizes animals through their expressive body language (Wemelsfelder et al., 2000, 2001). It is important that observers do not describe what physical behaviour the animal is performing (e.g. walking, lying), but the expressive manner, or style, in which it is performing the behaviour (e.g. relaxed, tense). This approach has generally shown acceptable reliability and validity as an indicator of animal emotion (Wemelsfelder and Mullan, 2014). QBA has been applied as an indicator for animal welfare in various species, to reflect differences between treatment groups (e.g. cattle: Stockman et al., 2011, 2012; pigs: Temple et al., 2011; Rutherford et al., 2012; horses: Fleming et al., 2013), to assess human perception of animals (Wemelsfelder et al., 2012; Duijvesteijn et al., 2014), and human behaviour towards animals (Ellingsen et al., 2014). The animal can be observed either live or from video and the scoring method can rely upon observers selecting their own terms (Free Choice Profiling) or by means of a list of pre-selected terms (Wemelsfelder et al., 2001). The advantage of QBA is that it can be applied from video, enabling the observation of specific moments which otherwise would be difficult to observe (e.g. rapidly after an aggressive encounter), and does not require the animal to undergo certain training or a test which could obscure the animal's initial emotional response.

The objective of this study was to investigate whether pigs which have just won or lost a fight differ in their expression of emotion and whether this can be detected by using QBA with a pre-selected list of terms. In addition we related QBA scores to the number of skin lesions to reflect the severity and type of aggression (Turner et al., 2006), and to blood lactate and blood glucose to reflect the physiological effort and fatigue (e.g. Briffa and Sneddon, 2007). Short video clips of pigs which had just won or lost a fight were shown to a group of pig farmers who were unaware of this distinction between pig groups, and scored the pigs for their behavioural expression using a list of 21 pre-selected descriptors of emotions. We hypothesized that winners would be more positive in their valence of affect and more active than losers (Otten et al., 2002). Furthermore, we hypothesized that measures of physical injury and cost would be predictive of subsequent emotional state irrespective of fight success.

2. Methods

The QBA was carried out based on video footage obtained from a previous experiment on aggression in pigs. The details of this experiment are described in Camerlink et al. (2015) and will therefore only be described briefly here. The work on animals was approved by SRUC's Animal Ethics Committee (no. ED AE 21-2014) and the UK Government Home Office legislation (project licence PPL60/4330).

2.1. Obtaining video footage

Video footage was collected from pigs which had just experienced a fight in an experimental setting. Pigs were kept in litter groups from birth (approximately 12 sibs together) without being mixed with unfamiliar pigs. They were kept in a pen measuring 1.9×5.8 m (ca. 1.1 m²/pig) with a solid floor and light straw bedding. At 10 weeks of age pigs were staged into a dyadic contest in a separate and novel test arena, with contests balanced for aggressiveness, sex and body weight. Dyads were formed between
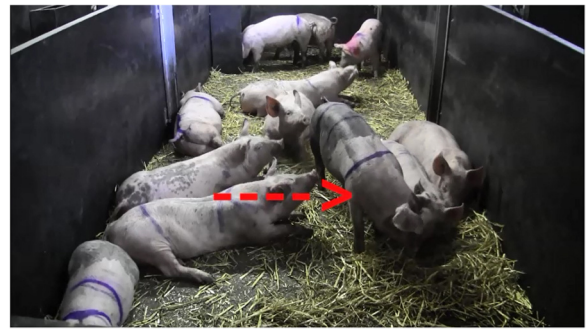

Fig. 1. Example of the video footage used for the QBA. The arrow indicated at the start of each clip which pig was to be observed.

unfamiliar pigs of equal body weight (<5% difference). For the contest, the two contestants were moved one by one out of their home pen and entered into the test arena simultaneously. The contest was ended when a clear winner was apparent, which was when the loser retreated without showing aggression for the following 2 min. Contests lasted on average 5 min. The pigs were returned to their home pen within 2 min of the end of the contest.

A camera (Canon Legria HF M52 with a wide angle lens) placed on a tripod at the height of the home pen (as close as possible to pig eye-height) was switched on from the moment that the pig returned to its home pen and recorded for 15 min thereafter. The camera enabled recording of high-quality colour footage and sound. Pigs were marked for identification with blue animal marker spray.

2.2. Injury and physiological costs of aggression

Skin lesions were counted by a single observer on the front, middle and rear of the body on a continuous scale. Skin lesions on the middle and rear were combined as they typically relate to the receipt of aggression whereas lesions on the front indicate involvement in reciprocal aggression (Turner et al., 2006). Skin lesions (only those which were bright red in colour and without scab formation) were counted live at the end of the contest day. On the QBA video footage the skin lesions were either not visible or very poorly visible due to the light, distance, and hair type (e.g. spots and patches of dark hair). In Fig. 1 an average example of the footage is given, showing that QBA participants were unaware of the amount of skin lesions.

Immediately prior to the dyadic contest and at the end of the contest, before return to the home pen, a drop of blood was sampled from the ear vein to obtain values of blood glucose and blood lactate of winners and losers. Values (in mmol/L) were obtained via a glucose meter and lactate meter developed for humans (see Camerlink et al., 2015 for a full description). Blood glucose and lactate indicate the fight intensity (fatigue) and can influence the behaviour during and directly after a contest (e.g. Briffa and Sneddon, 2007). The proportional change in mmol/L blood glucose and blood lactate (post value: pre value) was used for analyses.

2.3. Selection of video fragments

A total of 136 clips of post-contest behaviour were available (1:1 winner/loser). An observer unaware of the outcome of the contests (i.e. no knowledge of which pig won or lost) selected the videos based upon the following requirements: the pig should be visible; the footage should be of good quality; and selected footage should be of ~1 min duration within the first 5 min after the pig had returned to the home pen. After initial selection, 64 videos were re-evaluated on quality and variation in emotional expression (with the observer still being blind for which clips showed winners