Physiology & Behavior 182 (2017) 69–76

Contents lists available at ScienceDirect

Physiology & Behavior

journal homepage: www.elsevier.com/locate/physbeh

Docking piglet tails: How much does it hurt and for how long?

Pierpaolo Di Giminiani[a,*], Abozar Nasirahmadi[b], Emma M. Malcolm[a], Matthew C. Leach[a], Sandra A. Edwards[a]

[a] School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne NE1 7RU, United Kingdom
[b] Department of Agricultural and Biosystems Engineering, University of Kassel, D-37213 Witzenhausen, Germany

ARTICLE INFO

Keywords:
Pig
Tail docking
Pain
Vocalisation
Behaviour
Nociception

ABSTRACT

Tail docking in pigs has the potential for evoking short- as well as long-term physiological and behavioural changes indicative of pain. Nonetheless, the existing scientific literature has thus far provided somewhat inconsistent data on the intensity and the duration of pain based on varying assessment methodologies and different post-procedural observation times. In this report we describe three response stages (immediate, short- and long-term) through the application of vocalisation, behavioural and nociceptive assessments in order to identify changes indicative of potential pain experienced by the piglets. Furthermore, we evaluated the following procedural differences: (1) cautery vs. non-cautery docking; (2) length of tail removal. Sound parameters showed a significantly greater call energy and intensity exhibited by docked vs. sham-docked piglets ($P < 0.05$). Observations of general activity of the animals in a test situation failed to detect a difference among treatments ($P > 0.05$) up to 48 h post-tail docking. Similarly, no difference in mechanical nociceptive thresholds indicative of long term pain was observed at 17 weeks following neonatal tail docking ($P > 0.05$). The present results highlight the potential for the use of measures of vocalisation to detect peri-procedural changes possibly associated with evoked pain. Nonetheless, activity and nociceptive measures failed to identify post-docking anomalies, suggesting that alternative methodologies need to be implemented to clarify whether tail docking is associated with short- and long-term changes attributable to pain experienced by the piglets.

1. Introduction

Despite the existing ban on routine tail docking in the EU (European Directive 2001/93/EC, now codified in Council Directive 2008/120/EC), it is still a common husbandry procedure performed on > 95% of pigs across several European Member States [5,23]. Its utility as a preventive measure to reduce the risk of tail biting later in life [18] is undermined by the ethical concern regarding any immediate pain and distress associated with the procedure and by the possible long-term consequences experienced by piglets exposed to a painful mutilation as neonates without the provision of analgesia or anaesthesia [32].

To address the question of pain, researchers have so far focussed on the influence of different components of the procedure on behavioural and physiological measures, considered to be indicative of ongoing pain. Investigations on procedural differences have included: cautery vs. non-cautery docking [15,20]; inclusion of anaesthesia [31]; age at time of docking [1,15] and have primarily focussed on parameters of vocalisation at the time of docking, or on measures of activity immediately post-docking. More recently, docking of tails to different lengths has been suggested as having a possible effect on procedural pain responses, namely increased likelihood of squealing with increasing removal of tail tissue [8]. However the existing literature on tail docking presents contradictory results, in particular in relation to changes in general behaviours immediately following the procedure. The seeming lack of coherence may be due to the use of different sampling time points and the inclusion of additional husbandry procedures at the time of processing (e.g. castration, ear notching, teeth clipping). Behavioural recordings have been generally limited to the period immediately following docking with the most extended observations carried out until two [42] and five hours [8] post-procedure.

The question of the development of long-term, possibly chronic alterations in the behaviour or physiology of the animals is yet largely unexplored. Growth rate of the pigs has been previously utilised as an outcome indicator, with contradictory reports: a reduction in weight of piglets exposed to hot cautery docking observed up to two weeks post-procedure [20]; greater weight recorded seven weeks post-docking in hot cautery and blunt trauma docking compared to sham-cut pigs [42]; a reduction in daily gain up to ten weeks post-procedure, which included teeth clipping and tail docking [41]. Behavioural measures to investigate the development of possible chronic pain have been

* Corresponding author at: School of Natural and Environmental Sciences, Agriculture Building, Newcastle University, Newcastle upon Tyne NE1 7RU, United Kingdom.
E-mail address: Pierpaolo.Di-Giminiani@newcastle.ac.uk (P. Di Giminiani).

http://dx.doi.org/10.1016/j.physbeh.2017.09.028
Received 26 July 2017; Received in revised form 25 September 2017; Accepted 28 September 2017
Available online 30 September 2017
0031-9384/

reported only in one study, in which all animals were recorded from the farrowing to the growing stage, and suggested no difference in social behaviours during the nursery and grower phase, but an increase in resting time in the nursery period and an overall increase in exploratory behaviours in processed vs intact pigs [41].

While growth rate and general behaviours are proxy measures of pain induced by tail docking, they are non-specific and linked to more than just one condition. Describing the local sensitivity of the tail region may enable detection of anomalies in sensory functionality that may implicate the presence of pain. Specific long-term physiological effects of tail docking have been suggested by recent reports on the formation of neuromas in the tail tip of pigs several weeks following the procedure [9,16,29]. However, to date, no investigation has attempted to provide data on the potential effects of ongoing physiological changes using quantifiable nociceptive responses.

This study aimed at investigating the potential value of three distinct behavioural methodologies as indicators of pain at three different stages during and after tail docking: (1) the immediate reaction of the piglets to the docking, as expressed through vocalisations; (2) the acute and intermediate behavioural changes following tail-docking, as expressed through measures of spontaneous activity; (3) the long-term effects of tail docking through the assessment of changes in tail pain sensitivity.

2. Materials and methods

2.1. Animals and housing

All animal procedures were carried out under UK Home Office License (PPL 70/7919) and approved by the Animal Welfare and Ethical Review Board of Newcastle University. All female pigs, *Sus scrofa domesticus* (Landrace/Large White X synthetic sire line), belonged to the resident herd at Cockle Park Farm, Newcastle University. Three separate groups of animals were selected, with the following numbers of animals used for the three studies: 30 piglets (study 1), 72 piglets (study 2) and 24 pigs (study 3). For all studies, animals with no visible signs of injury, sickness, poor body condition, or abnormal behaviour were selected from different litters (6 piglets per litter). All animals were selected at 3 days of age and were previously subject to teeth clipping within 24 h post-farrowing.

All piglets were housed in farrowing pens measuring 1.8 m × 2.7 m, that consisted of a concrete and a partly slatted floor. Piglets had access to a creep area, which was heated by a 175 W infrared heat lamp (Interheat, Gyeonggi-do, South Korea) and had wood shavings as bedding material. Throughout the experiment, the room temperature ranged between 18 and 23 °C with an 8/16 h light/dark cycle. Pigs used in study 3 were tail/sham docked and subsequently ear-tagged for identification within the first week of life (refer to study design for details). After weaning they were housed in treatment groups under standard commercial conditions for each production stage, with ad libitum access to feed and water. Animals with tail damage were not selected and the appearance of any signs of tail and body injuries at any time previous to the test determined their exclusion. During the nociception test period, they were housed in groups of 8 animals in part-slatted pens (3 m × 3 m) with a daily provision of environmental enrichment (e.g. chewable hanging toys) and fresh straw in a controlled environment room, where the temperature ranged between 18 and 20 °C in the home pen. Fresh straw was provided daily.

2.2. Tail docking procedure

Tail docking was carried out according to normal commercial practice within 4–6 days of age and without the provision of anaesthesia or analgesia. At the time of docking, each piglet was picked up and restrained by a trained operator through fixation of the fore and hind legs. For study 2 and 3, a second observer recorded the total length at the lateral aspect of the tail (i.e. distance from the first proximal caudal vertebra to the tip) and drew a mark corresponding to 1/3rd or 2/3rd^{s} of the total length (refer to study design for details). A gas-heated docking iron (East Riding Farm Services, Driffield, UK) was applied to the tail mark and the distal proportion of the tail was removed. For study 1, tail docking was performed at 1/3rd of the intact tail length and included docking without cautery as an additional treatment, which was carried out with 19 cm Liston Bone Cutting forceps (World Precision Instruments, Hitchin, UK). Tail docking was performed adjacent to the farrowing crate where the sow and the rest of the litter were housed.

2.3. Study 1: vocalisation at docking

2.3.1. Experimental design

In order to evaluate the impact of different methods of tail docking on the vocalisation of piglets, the study comprised three treatment groups: intact (n = 10), hot-iron docking (n = 10) and non-cautery docking (n = 10). A total of 5 litters were allocated to the study. Within each litter 6 female piglets were selected and individually assigned at random to one of the 3 treatments groups (i.e. all viable piglets were colour-sprayed at selection and each colour was later assigned to a treatment by a collaborator blind to the design) in order to obtain 2 piglets/treatment/litter. Sample sizes were determined by a pre-existing design developed for the study of molecular profiling of long-term changes in piglets exposed to tail docking.

2.3.2. Experimental procedure

At the time of tail docking, the calls emitted by the piglets from the moment the tail was restrained and until its release by the operator, were recorded using a Sennheiser ME 66 Shot Gun Microphone (frequency response, 40–20,000 Hz ± 2.5 dB) powered by a Sennheiser K 6 battery unit (Sennheiser Electronic GmbH & Co. KG, Wedemark, Germany), and connected to a Zoom H6 digital recorder (48 kHz sampling frequency and 16-bit quantization; Zoom Corporation, Tokyo, Japan). All recordings were stored as uncompressed WAV files (sample frequency: 44.1 kHz, resolution: 16 bit). The microphone was held at a distance of 1 m from the head of the piglet.

Vocalisations were analysed individually by a developed algorithm in Matlab® (the Mathworks Inc., Natick, MA, USA). To remove low frequency noise (frequencies containing no useful information) produced by the ventilation system and animal grunts in the experiment unit, a 6th order Butterworth filter with pass band 1000 Hz and 10,000 Hz was applied. This bandwidth was selected based on previous research suggesting that it is meaningful in the context of a painful procedure [38]. In this study, the features calculated for each sound were the sound pressure level (SPL) in dB, maximum frequency in Hz and total energy of sound in Pa^{2}·s. Furthermore we estimated the peak-to-peak pressure (distance between the maximum peak and trough values for each call) from the SPL curve and calculated the average per piglet (dB). The sound analysis was performed by a treatment and time point-blind investigator.

2.4. Study 2: post-docking behaviour

2.4.1. Experimental design

To evaluate the impact of different lengths of tail removal from the piglets at docking on general behaviours, three treatment groups were designed: 'intact' (n = 24), 'short dock' - 2/3rds of original length removed (n = 24), 'long dock' - 1/3rd of original length removed (n = 24). Piglets were selected from a total of 12 litters (6 piglets/litter) and were assigned at random (as per study 1) within litter to one of the three treatment groups. To determine immediate and long-term changes evoked by tail docking, behavioural observations were made at the following time points: 10 min pre-, immediately (30 s) post-, 24 h and 48 h post-docking. The latter time points were chosen in order to