General Enquiries on the form should be made to:
anihwa Call Office
E-mail: ptj-anihwa@fz-juelich.de
Phone: +49 (0)2461 61 9286

anihwa Project Progress Report

(MID-TERM)

Project Title: Ending tail docking and tail biting in the EU - Hazard characterization and exposure assessment of a major pig welfare problem

Acronym: FareWellDock

Coordinator details:

Name: Anna Valros
Institute: University of Helsinki
Country: Finland
Phone: +358 50 4151242
e-mail: anna.valros@helsinki.fi

List other involved partners:
(Name, institution, country, phone, e-mail)

No.	Name	Institute	Country	Phone	e-mail
1	Lene Juul Pedersen	Aarhus University	Denmark	+4587157907	Lene.JuulPedersen@anis.au.dk
2	Andrew Janczak	Norweigan University for Life Sciences	Norway	+47 22597476	Andrew.Janczak@nmbu.no
3	Marc Bracke	Wageningen UR	Netherlands	+31 317 480558	Marc.Bracke@wur.nl
4	Sandra Edwards	Newcastle University	UK	+44 1912228350	Sandra.Edwards@newcastle.ac.uk
5	Armelle Prunier	INRA	France	+33 2 23 48 50 56	Armelle.Punier@rennes.inra.fr
6	Stefan Gunnarsson	Swedish University for Agricultural Sciences	Sweden	+4651167216	Stefan.Gunnarsson@slu.se
7	Dale Sandercock	SRUC	UK	+44 131 650 6585	Dale.Sandercock@sruc.ac.uk
(8)	Jeremy Marchant Forde (subcontracted)	USDA	USA	+1 765 494 6358	Jeremy.Marchant-Forde@ars.usda.gov

1. Summary of the project's progress

Consider each of the following items:

- *Main activities and achievements of the consortium in this period*
- *Your opinion on the internal cooperation and added value to the project*

Please state if developments within the projects or outside have caused you to amend any of the project's goals and, if so, in what way

The first part of the project has been a period of active planning, conducting pilot studies and data collection. In WP1 a pilot study has been performed to develop methodology for e.g. histopathological assessment of tail injury, recovery and traumatic neuroma formation, and in WP 3 a pilot study on the capture of optical flow data for identifying tail biting outbreaks has been completed. Furthermore, existing data have been successfully analysed to develop the screening method for exploratory materials in WP2, to evaluate the effect of tail biting and lameness on feeding behaviour in WP3, and to indicate a correlation between tail biting and tear staining in WP3. Some of the actual experimental studies have already completed the data collection stage. In WP1, the practical parts of two of the studies are finished: one on the long-term effect on social and human-animal behaviour of tail docking, and one on pain relief at tail docking. In WP2, a telephone survey to obtain descriptive data from Swedish farmers about pig housing and management, in relation to straw access and tail biting, was done in 2014, and the data are now being analysed. In WP3, data collection for the two studies related to behavioural and physiological changes after LPS injection has finished, as well the on-farm data collection for studying the effect of lameness and respiratory disease on tail biting- and sickness-related behaviour and physiology in pigs. In all remaining parts, data collection is currently ongoing. The milestones have thus been met to a very satisfactory degree, and in some cases the original milestones have been exceeded. The successful start of this project is also indicated by the fact that 14 congress presentations and three research manuscripts have already been submitted for publication, and one review article on the topic of tail biting and docking has been accepted. In addition, dissemination includes the project webpage (www.farewelldock.eu) and several publications at different stakeholder forums.

The cooperation within the network has been extremely fruitful and active. All partners have taken part in network meetings, and information, as well as research material, has been shared efficiently between partners. Cooperation within studies is active between several of the partners within and between WPs, and methodological protocols, e.g. for scoring tail lesions, have been developed together to be used throughout the project as a common basis.

Since the start in January 2014, the project has proceeded according to plan in most parts, and no changes have been made to the original goals.

2. Achievement of planned objectives

Describe the activities that have been performed during the first-half of the project to meet the objectives set in the proposal. Estimate the current degree of completion of the objectives.

WP1- Short- and long-term effects on welfare (including nociception and pain) of tail docking and tail biting.

To date, all milestones for the first half of the project period within WP1 have been achieved and in some case exceeded:

M1.1.1 (month 3) - All personnel were hired at NU and SRUC within the first 3 months of the project and all Home Office licences for undertaking studies on animals were approved and in place.

M1.1.2 (month 6) - See Section 3.

M1.1.3 (month 15) - Experimental work and analyses on pilot study have been completed and details of main 3x3 factorial study agreed.
M1.3.1 (month 10) - Experimental work and analyses of analgesic treatment in neonatal tail docking has been completed.

The objectives of WP 1 are as follows (degree of completion):

• To characterise the time course of traumatic neuroma development caused by tail resection (80% completed).
• To assess the short (acute trauma), medium (post trauma inflammation) and long term (traumatic neuroma formation) pain associated with tail docking in neonatal piglets, and the possible consequences for longer term fear of humans. At a more fundamental level, this provides a model of the effects of nerve damage (amputation) in neonates, subsequent neuroma development and its effects upon nociceptive processing throughout life (50% completed).
• To assess the effects of tail-damage in more mature pigs on neuroma formation and stump pain sensitivity. This will provide a basis for assessing the pain associated with being tail bitten in later life. At a more fundamental level, this provides a model of the effects of nerve damage (amputation) in later life on nociceptive processing (50% completed).
• To assess the effects of a NSAID on the short term responses to neonatal tail docking. (90% completed).

WP 1.1
Activities:

Pilot studies based on 32 female pigs (16 intact/16 tail docked) were undertaken at NU between November 2013 and April 2014, with collection of tails and neural tissues post-mortem for histopathological assessment of tail injury, recovery and traumatic neuroma formation at different times (1, 4, 8 and 16 weeks) after tail docking (2/3rds tail amputation at 3 days after birth). In addition, four tails were collected at the time of docking to characterise tail caudal nerve composition using Transmission Electron Microscopy (TEM) to determine the presence and relative proportion of primary sensory afferent nerve fibres associated with nociception and pain (A-delta and C-fibres) at the site of docking injury (ca. 8th-10th caudal vertebrae). Prior to euthanasia and post mortem tissue collection, some of the pigs were used in the development and refinement of the methods for the assessment of nociceptive sensitivity in the pig tail before and after tail injury and the development of novel behavioural analyses at different times after tail docking (e.g. pain/grimace face).

Healing of the superficial tissues in the docked pig tail following hot iron cautery progressed satisfactorily. Tails appeared fully healed superficially 4 weeks after docking and did not exhibit indications of on-going local inflammation or infection at this time or later in life (i.e. 2 – 4 months after the induction of tissue trauma). Non-specific epidermal and dermal changes associated with tissue thickening and healing (granulation tissue) were observed 1-4 months after docking. Some mild superficial and deep neutrophilic dermatitis was present in some tails, although this and the aforementioned non-specific changes are not likely to cause pain or be painful in themselves. On the whole there were no non-neural features (linked to the initial lesion) observed 1-4 months after tail docking that were consistent with the likely experience of long-term pain after docking.

Traumatic neuroma and neuromatous tissue development was evident one month after tail docking but not observed 1 week after tail docking. Over time there was marked nerve sheath and axonal proliferation in an attempt at neural re-connection leading to the eventual formation of "neuromas"

which presented either as a focal circumscribed feature and/or dispersed throughout the stroma of the granulation cap. It would appear 4 months after tail injury that neuroma formation may still be incomplete with possible implications to the sensitivity of the tail stump.

In conjunction with the histopathological studies on pig tail tips, on-going gene/protein expression analyses are being carried out on caudal spinal cord and dorsal root ganglia from intact and tail docked pigs to investigate alterations in the expression of Activating Transcription Factor 3 (ATF3) and NMDA glutamate receptor subunit 2B (GRIN2B). ATF3 is a member of the ATF/cyclic AMP responsive element binding protein (ATF/CREB) family of transcription factors and is induced in neuronal and non-neuronal tissues in response to injury, stress and infection. ATF3 gene expression is markedly increased in motor and sensory neurons following peripheral nerve injury. The NMDA glutamate receptor subunit GRIN2B participates in chronic pain processing in the spinal dorsal horn. These analyses are near completion (estimated end of June 2015).

The protocols for the main 3x3 factorial study of longitudinal assessment of the pain associated with different extents of tail resection at different ages have been piloted and agreed. Data collection is in progress according to plan and the completion of all animal work is expected by November 2015.

Methodologies to characterise the levels of tail sensitivity corresponding to different stages of traumatic neuroma development have been developed. Two different assays of mechanical nociception are applied to the pigs: von Frey filaments and Pressure Application measurement device. To date, baseline values of mechanical thresholds of sensitivity in intact tails have been recorded for pigs at the age of 16 weeks. Following surgical removal of either 1/3 or 2/3 of the tail, measures of tail sensitivity have been recorded 1 week and 8 weeks post-operatively. In addition to the quantification of thresholds of tail sensitivity, values of superficial tail skin temperature have been recorded with thermographic technology at the time of tail docking/resection and in correspondence of each time point of testing.

The characterisation of longitudinal changes in tail sensitivity comprised the analysis of general home-pen behaviours indicative of possible pain experienced by the pigs throughout the different stages of their growth (e.g. interaction with pen mates, behaviours directed towards environmental enrichment, measures of general levels of activity). Recordings of general behaviours have been routinely carried out from neonatal to finishing ages as planned and data will be available for analysis by November 2015.

Facial expressions of the pigs have also been recorded at different stages of their life to develop a scoring system with the ultimate objective of assessing changes in specific facial action units indicative of pain following tail docking/resection. Video recordings of the faces of all neonatal pigs included in WP1 have been obtained at baseline (pre) and immediately post-docking. Similarly, in order to determine whether tail resection in older growing pigs is inducing facial expressions indicative of acute pain, recordings of the faces of the animals have been carried out before and after the surgical procedure. Later in life, pigs have been filmed to obtain facial images at the time of threshold testing (1, 8 and 16 weeks post-docking/resection) to evaluate whether the traumatic injury evokes changes in facial expressions beyond the time immediately following the event.

WP 1.2

Activities:

A longitudinal experiment at the experimental farm of INRA UMR PEGASE, comparing the behaviour and physiology of 48 intact, 48 docked and 48 sham docked piglets has been completed. The

experimental animals were followed from neonatal docking until one month of the finishing period. Assessment of pain behaviour and social behaviour directed toward the tail were made around the time of docking and then weekly until the end of the experiment. These were concomitant with scoring of the tail state and tear staining based on standardized protocols used for FareWellDock. Fear of humans was evaluated once during each of the suckling, post weaning and finishing periods. Blood samples were collected at the end of the experiment to quantify cortisol and ACTH.

WP 1.3

Activities:

An experiment has been conducted in collaboration with V Courboulay from IFIP at the experimental farm of IFIP (F-35000 France). Meloxicam treatment of piglets is routinely performed in France to alleviate pain due to surgical castration. Two trials were carried out using a similar experimental protocol in order to 1) evaluate the efficacy of meloxicam (M) to relieve pain due to tail docking (Q) performed at 2 or 5 days of age, 2) evaluate the influence of tail docking (Q) and surgical castration (C) performed at the same time, and evaluate, in this situation, the efficacy of meloxicam associated or not with butorphanol (B) to relieve pain. In trial 1, piglets were tail docked with a hot cautery iron at 2 or 5 days of age after intramuscular injection of meloxicam (M) or saline (P), or were only handled (T). In trial 2, 2-day old piglets allocated to five experimental groups were compared: C/M, Q/M, QC/M, QC/MB, QC/P. Post-operative behaviour was recorded in 24 piglets per treatment and age, and blood sampling was performed on 21 to 23 other piglets.

Tail docking induced more tail trembling ($P < 0.001$) but other post-surgical behaviours did not differ significantly between treatments. Plasma cortisol was lower in T than in P piglets ($P < 0.05$) and intermediate in M piglets (77.2 ± 22.4, 86.7 ± 18.1 and 97.8 ± 25.5 ng/ml in T, M and P piglets, respectively), suggesting a partial pain relief. Pain-related indicators varied with age but it was not possible to conclude whether tail docking is more or less painful at one or the other age. Performing both interventions at 2 days of age induced an acute pain similar to that observed after castration alone. Standing and exploring were more frequent ($P < 0.05$) while plasma cortisol level was lower ($P < 0.1$) in QC/MB than in QC/M piglets. The responses of piglets suggested better pain alleviation by the combined MB treatment than by the M treatment alone, but this alleviation was still incomplete.

WP 2 Tail biting and enrichment

The milestones for the first half of the project have been reached within WP2 as follows:

M2.1.1 (month 6) - Data transcription completed

M2.1.2 (month 12) – The decision has been made for a first prototype of the screening method

M2.1.3 (month 18) – This part will partly be completed later on during the project (also see 4. Problems and changes in objectives)

M2.2.1 (month 6) This part has been delayed due to personnel issues, but is now ongoing.

M2.2.3 (month 12) Web pages have been launched

The objectives of WP 2 are as follows (degree of completion):

- To develop and validate a protocol for an animal-based screening method, based on exploratory behaviour and skin/tail lesions, for what constitutes a sufficient quantity of rooting material (75 % completed).
- To explore the feasibility and validity of using AMI sensors and tear staining to measure the value of enrichment materials under farm conditions (65% completed).

•To test the effect of straw length, slat width and manure handling methods on pen functioning and ease of manure handling, and to describe suitable methods for implementing use of straw under commercial farming conditions (10% completed).

• To make scientific information on methods to reduce tail docking and improve enrichment better accessible to farmers, policy makers and the general public through the establishment of a web tool and publications in farmer magazines (50% completed).

•To investigate, under farm conditions, the efficiency of tail docking vs. enrichment given in sufficient quantity to reduce the occurrence of tail lesions (5% completed).

WP 2.1 The use of animal-based measurements to assess adequacy of enrichment provision

Activities:

Behavioural observations of existing video of pigs (40 and 80 kg) housed with either 10, 80, 150, 220, 290, 360, 430 or 500 g straw per pig and day showed that straw-directed behaviour and the percentage of pigs engaged in straw directed behaviour increased with increasing amount of straw. By contrast the pattern for pig-directed behaviour and tail lesions showed a decrease with increasing amounts of straw. Based on these data, a screening method has been developed to identify the type and amount of observation minimally needed to determine which quantities of straw are insufficient. The screening prototype on pen-level will include: 1) scoring of the amount of left-over-straw, 2) straw-directed behaviour before and after straw allocation, and 3) tail-lesion scoring. The screening method will be used and further validated in the Swedish study, Part 2, where the straw amount at "normal" farm level will be compared to the double amount on several farms. Also there will be pens within the same farms given 400-500 g straw/pig/day as a "golden standard" comparable to the maximum amount used in the DK study from which the screening method has been developed.

AMI sensors are being tested on (experimental) pig farms, esp. as a collaboration with other research projects, including the field trial in the UK (WP 3.3) and exploring both enrichment value and (several) background conditions such as the presence/absence of tail/flank biting in the pen.

Details on the progress regarding tear staining studies are reported under WP3.

WP 2.2 Practical on-farm implementation and incentives for the use of enrichment materials

Activities:

The objective of WP 2.2 was to test the effect of straw size, slat width and manure handling methods on pen functioning and ease of manure handling, and to describe suitable methods for implementing the use of straw under commercial farming conditions. A telephone questionnaire with 108 questions about basic farm data including housing, feeding and management routines was performed in 2014. The aim of the survey was to obtain descriptive data from Swedish farmers about pig housing and management in relation to straw access and tail biting in nursery and finishing pigs. Data were obtained from 60 farmers, of which 46 farms had weaners (average 1090 pigs places; range 126 - 4000) and 43 farms had finishing pigs (average 1430 pigs places; range 132 - 6500). In 50% of the nursery farms tail biting was never seen, and in 39% tail biting was seen ≤2 times/year, in 8% 3-6 times/year and in 2% ≥1 times/month. Farmers with finishing pigs reported on average 1.6% tail bitten pigs per batch (min 0.1; max 6.5). All farms used straw, and straw was cut or chopped in 78% of the nursery farms and in 74 % of the finishing farms. On average straw was distributed 7.5times/week (min 0.5; max 14).

The objective to make scientific information on methods to reduce tail docking and improve enrichment better accessible to farmers, policy makers and the general public has been addressed

through the web tool (www.farewelldock.eu), and information will be presented in farmer magazines. Project output (publications) so far are listed on the website at the bottom of: http://farewelldock.eu/info/factsheets/project/ , classified as conference contributions, scientific publications, farm magazine articles, internet articles and other communication activities.

WP 2.3 The efficiency of enrichment versus tail docking to reduce tail biting

Activities:

The experimental work and data collection will start in June 2015.

WP 3 Identification of individual and group characteristics predisposing pigs to tail biting

To date, most milestones for the first half of the project period within WP3 have been achieved. Due to some changes in timing of different milestones, some are slightly behind schedule, some are much further than anticipated:

M3.1.1 (month 18) - Data collection of LPS pigs is finished, and the on-farms study was planned in parallel with the LPS study.

M3.1.2 (month 20) - The data set on feeding changes due to disease has already been analysed and a manuscript submitted for publication

M3.1.3 (month 24) - The on-farm data collection is finished

M3.1.4 (month 30) - Molecular and behavioural analysis is ongoing

M3.2.1 (month 6) - A decision on which data to collect for tear staining has been done for most parts. Data for the behavioural sequencing has already been analysed, but more data might be needed.

M3.2.2 (month 8) - The pilot data were analysed and a manuscript has been submitted for publication. Further data collection protocols have been planned with the entire network.

M3.2.3 (month 14) This analysis is in progress

M 3.3.1 (month 6) Pilot studies have been completed

The objectives of WP 3 are as follows (degree of completion):

- To clarify the role of poor health in the causation of tail biting and victimization. Information will be gathered on behavioural signs of sickness in pigs, and on its effects on group dynamics (75 % completed)
- To increase knowledge about the sickness behavior of pigs suffering from different physical injuries and infectious conditions, occurring also in tail biting outbreaks. This in turn can be used when management and facilities for sick pigs are planned in the future, to decrease the adverse effects of such outbreaks (50% completed)
- To study the underlying central and peripheral stress- and immune-related mechanisms in detail to give insight into factors predisposing pigs to become tail biters or victims. (50% completed)
- To determine the characteristics of individuals for reliable identification of pigs at risk of becoming a tail biter or victim, including tail-biting related and social behaviour, and tear staining (50 % completed)
- To develop automated systems for early warning of tail biting outbreaks which could be used especially in large herds (10% completed)

WP 3.1 Sickness behaviour and tail biting

Activities:

Part 1. Sickness effects on feed intake

An existing dataset with information on a total of 2672 pigs was used to study changes in feeding behaviour of tail bitten or lame compared to healthy control pigs around the day of diagnosis. Data on individual feed intake was obtained from an automatic feeding system. The data have been analysed and a paper submitted to Livestock Science in February 2015. Results indicate that both lameness and tail biting have a significant effect on feed intake: reducing intake already long before the diagnosis. Lameness appears to reduce the feed intake more severely than tail biting

Part 2. Sickness behaviour, on-farm study

Data collection from a commercial farm has been completed to study effects of osteochondrosis and respiratory tract disease on social behaviour in pigs, with a focus on behaviour possibly related to tail biting. We now have data for approximately 20 pigs with osteochondrosis, 20 with respiratory tract disease, and 20 control pigs without any history of disease. The study was planned in collaboration between FI and NO, with FIN responsible for analyses of behaviour and feed intake. Behavioural scoring was started in May 2015, and molecular analyses of blood samples are ongoing.

Part 3. Sickness behaviour, LPS-studies

Data collection from individually housed LPS pigs has been completed on the basis of a study testing effects of LPS injection on physiology and behaviour of catheterized pigs. Analysis of immune parameters and behaviour has been started.

A study on changes in social behaviour in group-housed pigs was planned in collaboration between NO and FI. Experiments were performed during spring 2015 and behavioural analyses will be performed in FI.

WP 3.2 Identification of pigs at risk of being bitten or becoming tail biters

Activities:

Part 1. Sequence analysis

This part is done in collaboration between FI and USDA, USA. Behavioural observations have been completed (June – August 2014) using existing video material from FI. The data have been preliminarily analysed in the USA and statistical analyses are still ongoing. Based on the results of these analyses a decision will be made whether more behavioural data are needed. There are video data available from a FR study – these videos have already been sent to FI.

Part 2. Social and phenotypic risk factors for tail biting

An existing data set is currently being analysed to determine if social behaviour and dynamics, as well as pig health and growth is related to tail biting on long term. A social network analysis method is being used.

Part 3. Tear staining

This part is done in cooperation between FI and USA, and further data are collected also in at least FR, UK and DK. Based on data from a previous on-farm study in FI we were able to identify a correlation between tear staining and tail biting. These data have been presented at the WAFL congress, and a manuscript has been submitted to Animal in 2014.

Sampling of tear staining has been incorporated in studies performed in FR (data already collected), UK and DK. In addition, SE is evaluating the possibility for collecting further data.