Home Office

NON-TECHNICAL SUMMARY

Studies to assess and improve the humaneness of stunning methods for poultry

Project duration

5 years 0 months

Project purpose

- (a) Basic research
- (b) Translational or applied research with one of the following aims:
  - (iii) Improvement of the welfare of animals or of the production conditions for animals reared for agricultural purposes

Key words

Animal welfare, Poultry, Waterfowl, Stunning, Slaughter

Animal types	Life stages
Domestic fowl (Gallus gallus domesticus)	adult
Domestic goose (Anser spp)	adult

Retrospective assessment

> The Secretary of State has determined that a retrospective assessment of this licence is not required.

Objectives and benefits

Description of the projects objectives, for example the scientific unknowns or clinical or scientific needs it's addressing.

What's the aim of this project?

To examine the effectiveness and humaneness of existing and new stunning and slaughter methods for poultry.

Potential benefits likely to derive from the project, for example how science might be advanced or how humans, animals or the environment might benefit - these could be short-term benefits within the duration of the project or long-term benefits that accrue after the project has finished.

Why is it important to undertake this work?

There is an urgent need for more humane stunning and slaughter methods for poultry (including waterfowl) designed for human consumption. Stunning prior to slaughter is commonly used to render the animal unconscious prior to and during bleeding, with the aim of reducing pain and distress. The majority of poultry slaughtered in the UK are stunned using controlled atmospheric stunning (CAS) with CO2, or by electrical waterbath. However, it is recognised that exposure to CO2 can cause pain, anxiety, breathlessness and nausea. Meanwhile electrical waterbath stunning is widely recognised as having significant welfare issues, such as the risk of pre-stun shocks, sub-optimum stuns, suspension of conscious birds upside down (which is stressful and, in some cases, painful) and variations in electrical current delivered to birds in multi-bird waterbath stunners. In addition, head-only electrical stunning (non-waterbath) that is often employed on small scale producer/processor waterfowl units, is widely recognized as ineffective. Nevertheless, this method is still used by a number of producer/processors (often with illegal DIY high voltage stunners). There is an urgent need for up-to-date research on the head-only electrical stunning of waterfowl, as there are no minimum required currents under UK (WATOK 2015) or EU (EC1099/2009) legislation for ducks or geese and little published peer-reviewed information on the effectiveness or otherwise of this method in these species.

What outputs do you think you will see at the end of this project?

The expected outputs of this project will be the potential development of new stunning methods and parameters for poultry that improve welfare at the time of slaughter. The results of this project will be disseminated by peer-reviewed scientific publications, presentation at scientific and industry conferences, the development and distribution of fact sheets based on the key findings of the project to the poultry industry, government bodies, animal welfare NGOs and stunner manufacturers. Potentially, part of this work will lead to new stunning and slaughter systems for poultry (including waterfowl).

Who or what will benefit from these outputs, and how?

The expected welfare benefits of the proposed studies are the refinement of existing methods and development and testing of new stunning systems which will reduce distress and improve the quality and duration of unconsciousness following stunning. The project will also develop stun parameter guidelines (e.g. minimum currents for waterfowl), which can be used for existing stunning systems to improve welfare at slaughter. The results from the proposed project would provide scientific evidence that could directly underpin legislation (UK, EU and worldwide). These findings would also have direct relevance to animal welfare NGOs (development of guidelines and training), other animal charities, poultry producers and stunner manufacturers.

How will you look to maximise the outputs of this work?

If appropriate and with permission of the funding bodies, key findings of the project will be used to help promote the welfare of poultry during stunning/slaughter to the general public, this will be in the form of press releases and invited presentations. Unsuccessful results of developed approaches will be submitted for publication.

Species and numbers of animals expected to be used

- Other birds: No answer provided
- Domestic fowl (Gallus gallus domesticus): 40

Predicted harms

Typical procedures done to animals, for example injections or surgical procedures, including duration of the experiment and number of procedures.

Explain why you are using these types of animals and your choice of life stages.

Chickens, geese and ducks are being used, as they are the species in which these stunning methods are currently or will be used commercially for slaughter for human consumption. Birds used in this project will be of commercial slaughter age and weight to mirror industry practice.

Typically, what will be done to an animal used in your project?

The effectiveness and relative humaneness of stunning methods and parameters (magnetic induction heating, captive bolt, electrical stunning) will be assessed in this project. This will involve the evaluation of consciousness/sensibility with behavioural/brainstem indices and assessment of the electrical activity of the brain. This will be conducted in anaesthetised (non-recovery) and non-anaesthetised birds. The use of a non-recovery anaesthesia model for the first part of the magnetic induction heating study allows the assessment of brain function and temperature in response to this novel stunning method while reducing the potential for suffering. In this model stunning parameters will be revised and will be used in subsequent non-anaesthetised studies.

Anaesthesia and non-anaesthesia studies

Assessment of the electrical activity will involve the implanting prior to stunning of sub-dermal needle electrodes in the skin over the head. The recording electrodes will allow the assessment of the following electrophysiological indices: Global electroencephalographic (EEG), visual evoked potentials (VEPs) and/or somatosensory sensory evoked potentials (SEPs). These will be recorded from birds prior to and after electrical stunning and allow the assessment of brain function.

Anaesthesia magnetic induction heating only

In addition to the above, fibre optic temperature sensors will be implanted within the brain of anaesthetised chickens. This will allow assessment of brain temperature in response to the stunning method. Anaesthesia will be non-recovery with all birds Schedule 1 killed with an overdose of anaesthetic.

Non-anaesthesia studies only

The duration of behavioural and brain activity assessment after stunning will be until recovery of recorded electrophysiological and behavioural indices sufficient to meet the studies scientific requirements, this is envisioned to be a maximum of 1 minute of uncontaminated data, based on prior experience. With an absolute maximum total recording time of 5 minutes. This allows for assessment of stun-induced unconsciousness, recovery and the effects of the stun on the immediate health status of the bird. The determination of the period of induced unconsciousness is essential in determining if the period of unconsciousness is sufficient to prevent birds from experiencing pain and distress either prior to, during or after the bleeding process in commercial slaughter. A secondary benefit of this approach is the demonstration of recoverability which is an important requirement for acceptability for halal slaughter. The lack of demonstration of recoverability with the proposed stunning methods, could lead to the non-adoption of the proposed methods, which could result in birds being slaughtered without stunning, which would cause serious welfare harm. Immediately after recovery all the birds will be euthanised. The period of assessment will be refined during the experiment and if deemed appropriate will be reduced.

What are the expected impacts and/or adverse effects for the animals during your project?

Potential impacts could include:

- Stress from handling, this is unavoidable, but will be minimised when possible. Birds will be acclimatised to people and handling prior to use.
- Stress/discomfort during induction of anaesthesia, this is unavoidable, but will be minimised when possible with good animal handling and veterinary care.
- Pain/discomfort from positioning of EEG electrodes. This is unavoidable, small diameter EEG electrodes (27G) will be used to minimise discomfort.
- Pre-stun shocks with electrical stunning, will be continuously examined for in all birds. Any shock will be transient before the induction of unconsciousness.
- Spinal seizures with electrical stunning when the animal is conscious will be continuously monitored for with assessment of the raw EEG trace and animal behaviour/brainstem reflexes. If

an animal is identified as having a spinal cord seizure it will immediately be euthanized. Spinal seizures in two birds in a treatment batch would serve as a stop point in experimentation and require re-evaluation and alteration of electrical stunning parameters.

- Pain/discomfort with heating of tissues prior to induction of unconsciousness with magnetic induction heating study. This will be continuously monitored for, any discomfort is expected to be transient before the induction of unconsciousness.
- Distress associated with recovery from the stun. This is unavoidable in recovery experiments. The assessment period will only be until recovery of recorded electrophysiological and behavioural indices for sufficient to meet the studies scientific requirements, this is envisioned to be a maximum of 1 minute of uncontaminated data. The total recording period (included periods of unconsciousness) will be a maximum of 5 minutes and the birds will be immediately euthanised after this period.

Expected severity categories and the proportion of animals in each category, per species.

What are the expected severities and the proportion of animals in each category (per animal type)?

Expected severities for each protocol/species type:

- Protocol I Magnetic induction heating of anaesthetised chickens, 100% non-recovery, chickens.
- Protocol II Magnetic induction heating, of chickens: mild 50% (non-recoverable stun to kill), moderate 50% (recovery).
- Protocol III Captive bolt stunning of ducks and geese: mild (90%), moderate (10%).
- Protocol IV Electrical stunning of ducks and geese: moderate (100%).

What will happen to animals at the end of this project?

- Killed

Replacement

State what non-animal alternatives are available in this field, which alternatives you have considered and why they cannot be used for this purpose.

Why do you need to use animals to achieve the aim of your project?

Chickens, geese and ducks are being used, as they are the species in which these stunning methods are currently or will be used commercially for slaughter for human consumption.

Which non-animal alternatives did you consider for use in this project?

Prior to live animal experimentation, mathematical modelling (magnetic induction heating) and cadavers will be used to refine the developed methods and parameters prior to live animal testing.

Why were they not suitable?

There is no meaningful way to assess the time to induction of unconsciousness, time to return of consciousness and minimum time to induction of brain dysfunction in models, birds that are already dead or with other non-animal alternatives.

Reduction

Explain how the numbers of animals for this project were determined. Describe steps that have been taken to reduce animal numbers, and principles used to design studies. Describe practices that are used throughout the project to minimise numbers consistent with scientific objectives, if any. These may include e.g. pilot studies, computer modelling, sharing of tissue and reuse.

How have you estimated the numbers of animals you will use?

The numbers of experimental animals proposed are based on publications, which assessed the head-only electrical and captive bolt stunning effectiveness in chickens and turkeys. Where possible sample sizes have been reduced to the minimum required for generating meaningful results.

What steps did you take during the experimental design phase to reduce the number of animals being used in this project?

The ARRIVE 2.0 guidelines were followed when designing the different aspects of this project. Study design in each protocol was designed to maximise data collection while reducing the number of birds required. Each animal is to act as its own control. Sample sizes were determined with standard power analysis based on recently published research. In addition to this a step up/down approach is to be used in protocol 4. This has further reduced the number of birds which would otherwise be used for determining electrical stunning parameters.

What measures, apart from good experimental design, will you use to optimise the number of animals you plan to use in your project?

A combination of computer models and cadaver testing have been (and will be) used to refine the stunning parameters and for testing theoretical performance. This has resulted in the number of birds required to assess stunning performance has reduce significantly from the previous project licence.

Where possible, information will be gathered for different protocols from the same procedure, ultimately minimising animal numbers. In addition, when it has been determined that sufficient data has been collected, sample sizes will be reduced and remaining animals instead used in later protocols.

Refinement

Give examples of the specific measures (e.g., increased monitoring, post-operative care, pain management, training of animals) to be taken, in relation to the procedures, to minimise welfare costs (harms) to the animals. Describe the mechanisms in place to take up emerging refinement techniques during the lifetime of the project.

Which animal models and methods will you use during this project? Explain why these models and methods cause the least pain, suffering, distress, or lasting harm to the animals.

The use of and constant monitoring of the terminal anaesthesia in the magnetic induction heating experiment will prevent pain, suffering and distress to birds. This model allows the testing and refinement of parameters without compromising welfare, this information will then inform subsequent experiments. In recovery experiments, birds will be carefully and constantly monitored for signs of excessive pain and distress (distress calls, rapid ventilation, rapid head shacking etc). After recovery experiments birds will be immediately euthanised to prevent lasting harm. Of the treatment groups electrical stunning has also been shown to produce a period electroanalgesia in poultry, when allowed to recover. This will reduce the potential for pain associated with recovery. Meanwhile captive bolt has been demonstrated to produce instantaneous irrecoverable stun in turkeys, which will prevent pain and suffering.

In a previous licence a local anaesthetic cream was applied to desensitise the skin prior to placing electrodes for assessment of the electrical activity of the brain. This was put into that licence as a refinement. However, it was found in experiments with turkeys that the additional capture and handling of the birds for placement of the LA cream caused moderate stress compared to the relatively mild pain associated with subdermal (under the skin) electrode placement. This requirement was removed in the amendment to that licence. In the subsequent experiments using these electrodes there were no obvious signs of pain and distress with the placement of electrodes without the local anaesthetic cream, birds were less stressed and easier to handle. This example demonstrates that in some cases the refinements made to improve animal welfare can have unforeseen consequences and cause harms. This highlights the need for constant monitoring of welfare even after introduction of refinements.

Why can’t you use animals that are less sentient?

Chickens, geese and ducks are being used, as they are the species in which the stunning methods are currently or will be used commercially for slaughter for human consumption, there are no less sentient species that can be used for this research. The use of a terminal anaesthesia-based model removes the potential for pain and distress when evaluating the potential of magnetic induction heating as a stunning method. By using this model, parameters can be altered to test and improve potential effectiveness without causing further welfare compromise. This approach also reduces the number of non-anaesthetised birds needed in the following experiment. However, for time to induction of unconsciousness and time to return of consciousness, this can only be assessed in conscious birds.

How will you refine the procedures you're using to minimise the welfare costs (harms) for the animals?

Birds will be habituated to experimental staff prior to experimentation. This will include routine pen walks and low intensity handling. When birds are handled for experimentation care will be taken to avoid excessive or prolonged handling. All birds will be euthanised either during or immediately after experimentation.

The use of sub-dermal needle electrodes has been found in the previous two licences to provide sufficient signal quality without the need for anaesthesia and surgery, which is commonly used in welfare at slaughter experiments. In these licences this was a significant refinement that removed the need for induction of anaesthesia, surgery and recovery, which would have caused stress and pain.

What published best practice guidance will you follow to ensure experiments are conducted in the most refined way?

The ARRIVE 2.0 principles will be followed for experimental reporting in study design to ensure the most relevant and transparent experimental design. The methods to be used in this project have been standardised and published in peer-reviewed journals and a PhD thesis.

How will you stay informed about advances in the 3Rs, and implement these advances effectively, during the project?

The institution, is active in dissemination of NC3Rs and3Rs relevant news, providing training and updates via a newsletter, emails and online notifications.