https://doi.org/10.5281/zenodo.11441129

Question raised by requestor

We would like to have some support regarding the animal welfare consequences of the use of devices producing electric current in farms. We are thinking of electric shepherds, both classical and the new ones (virtual fencing), devices for electroejaculation and others.

More precisely, we would like to know if there is some scientific background/information about the way to use (or why not use them) all those devices (e.g. control of the maximum current, etc.).

EURCAW *Ruminants & Equines* received the question 21 March 2024.

On their request, some relevant articles were sent to the requestor already before the present document was delivered. These articles were sent 12 April 2024.

Answer

Introduction

Overall, electrical devices use an aversion learning approach to train animals, and any electric shock received by the animal during this process is likely to cause the animal stress and pain. The effectiveness and acceptability of the application of electrical devices is likely to vary with context, available alternatives and possible benefits for animal welfare that cannot be practically achieved in other ways. Current scientific evidence and adopting the precautionary principle where scientific evidence is lacking, as well as the existence of legislation in some Member States, can be used to determine the acceptability of use of electrical devices.

There are several devices, designed to deliver electric shocks to animals, used on farms. Such electric devices are used in various parts of livestock management. Main categories of use are the following:

1. ***Electric fences*** are used to keep animals inside a defined area. An electric fence is a barrier that uses electric shocks to deter animals from crossing a boundary. Smooth steel wire is most often used for electric fences but also barbed wire and synthetic webbing and rope-like fencing materials woven with fine conducting wires are applied. Electric wire fences are used to contain livestock in order to manage grazing, prevent damage to land, and avoid animal injury by preventing them accessing settlements, highways or other potentially dangerous areas. It was developed and commercialized in the United States and New Zealand during the 1930s (1) and stands out as the most widely used device. Electrified wires are also used to prevent unwanted behaviours in other species such as the prevention of crib biting in horses (e.g. electrified wire on the stable door) and the prevention of climbing in goats.
2. ***Virtual fences:*** The aims of 'invisible' or 'virtual' fences are similiar to those of electric fences but invisible/virtual fencing sets a boundary using global positioning system (GPS) coordinates and applies audio or vibration cues in combination with electric shocks to alert animals that they approach the boundary of the allowable area. The cues are administered via a collar, band or metal chain worn around its neck.
3. ***Devices to move animals:*** Electrical devices to make animals move are used in various contexts. Such applications may be mechanical/automatic or applied by a human operator. An example of the first is a 'backing gate', which is applied in the waiting area before the cows enter the milking parlour. The gate consists of a slow-moving fence that gradually reduces the size of the waiting area. The fence may be fitted with electrical wire, which will shock any animal that touches it. This system trains animals to enter the parlour and eliminates the need to chase or handle animals in the collecting yard. In automatic milking robots, electrified wire ropes that touches the cow's back (referred to as a 'tickler') are applied to make cows leave the robot promptly after milking. Similar devices are used to expel cows from a cubicle to encourage the animals to go to the milking parlour or robot. So called 'cow trainers' are used to prevent unwanted behaviour in cows i.e. urination and defecation intside their stall. A cow trainer consists of a metal rod mounted horizontally a few centimeters above the cow's back and perpendicular to the spine. If a cow arches her back (e.g. to urinate) while she is standing in the front of the stall, she will come into contact with the cow trainer and receive an electric shock. The animals should learn to step backwards before urinating and defecating in order to avoid such shocks, thus keeping the stalls clean. An example

of a hand held device is an electric goad. This is an electrified stick or prod that is held by a stockperson at one end and with two electrodes at the other, which shock an animal touched by them. The device is used to spur or guide animals from one location to another.

4. ***Electro-immobilisation:*** Application of electrical currents is also used to temporarily paralyse animals, making them immobile for various procedures such as veterinary treatments, handling, or other management practices. This is called electro-immobilisation. The process involves passing an electrical current through the animal's body, which disrupts muscle function and causes temporary paralysis without causing unconsciousness.
5. ***Electro-ejaculation:*** used to assist in the collection of semen from males for artificial insemination. An electrical probe is inserted in the rectum and electrical pulses are released until the occurrence of ejaculation. This technique involves restraining.

Legislation

The following EU Directive and Regulations address welfare and management of Ruminants and Equines on farm, during transport and at the time of killing. For each, specific prohibitions or requirements related to the use of devices producing electric current are indicated.
The recommendations of the Council of Europe in the European Convention for the protection of animals are also included here, as they are part of the EU acquis and, consequently, EU Member states must implement them.

EUROPEAN CONVENTION FOR THE PROTECTION OF ANIMALS KEPT FOR FARMING PURPOSES (2)
Recommendation concerning cattle

Appendix A: Special provisions for bulls kept for breeding or fattening, fattening bulls

- The use of electrified wire to avoid bulls mounting each other should be avoided.

Appendix B: special provisions for cows and heifers

- Appliances delivering electric shocks other than for fencing purposes, should not be used.
- On the condition that they are properly inspected and, if necessary, re-adjusted to each individual animal, cow trainers may be switched on for the time necessary for training; they shall not be used during the perinatal period.

Appendix C: Special provisions for calves

- Electro-immobilisation shall not be used.

Recommendation concerning goats

- Electro-immobilisation shall not be used.
- Electro-ejaculation shall not be used other than for veterinary diagnosis when there is no other method available. In such exceptional circumstances, it shall be carried out under strict veterinary control.
- Electric fences shall be so designed and maintained that contact with them causes no more than momentary discomfort to the goats. Electrified mesh fences shall not be used for horned goats if they could present a risk for the animals.

Recommendation concerning sheep

- Electro-immobilisation shall not be used.
- Electro-ejaculation shall not be used other than for veterinary diagnosis when there is no other method available. In such exceptional circumstances, it shall be carried out under strict veterinary control.
- Electric fences should be so designed and maintained that contact with them causes no more than momentary discomfort to the sheep. Electrified mesh fences shall not be used for horned sheep if they could present a risk for the animals.

COUNCIL DIRECTIVE 98/58/EC concerning the protection of animals kept for farming purpose (3)

- Member States shall make provision to ensure that the owners or keepers take all reasonable steps to ensure the welfare of animals under their care and to ensure that those animals are not caused any unnecessary pain, suffering or injury.
- No specific prohibitions or requirements regarding electrical devices.

COUNCIL REGULATION (EC) No 1099/2009 on the protection of animals at the time of killing (4)

- The following methods of restraint shall be prohibited: the use of electric currents to immobilise the animal that do not stun or kill it under controlled circumstances, in particular, any electric current application that does not span the brain.
- The use of instruments which administer electric shocks shall be avoided as far as possible. In any case, such instruments shall only be used for adult bovine animals and adult pigs which refuse to move, and only when they have room ahead of them in which to move. The shocks shall last no longer than one second, be adequately spaced and shall only be applied to the muscles of the hindquarters. Shocks shall not be used repeatedly if the animal fails to respond.

REGULATION (EC) No 1/2005 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97 (5)

- The use of instruments which administer electric shocks shall be avoided as far as possible. In any case, these instruments shall only be used for adult bovine animals and adult pigs which refuse to move and only when they have room ahead of them in which to move. The shocks shall last no longer than one second, be adequately spaced and shall only be applied to the muscles of the hindquarters. Shocks shall not be used repeatedly if the animal fails to respond

A limited non exhaustive scan of legislation in different Member States showed that more specific legislation regarding electrical devices is implemented in several Member States. For example, Sweden banned the use of virtual fences, i.e. collars that give animals electric shocks. There is a prohibition in the Swedish Animal Welfare Ordinance (6) which states that it is forbidden to use electricity to control the behaviour of animals. The use of physical electric fences outdoors is exempted. In Finland electrical devices are forbidden except for physical electric fences.

Like in Sweden, the use of virtual fences where collars give animals electric shocks is forbidden in Austria. There is a prohibition in the Austrian Animal Welfare Act (§ 5 TSchG) (7, 8) which states that, to protect animals from pain, suffering or harm as well as severe fear, it is forbidden to use devices, which alter the animal's behaviour by punishment and harshness. However, in installations and housing facilities existing when the Austrian Animal Welfare Act came into force (2005), electric bars fitted over the withers ("cow trainer") may continue to be used if they are adjusted to the individual animal with a minimum distance of 5.00 cm between the bar and the withers and are switched on for a maximum of one day per week. Use is only permitted for pregnant heifers and pregnant cows and only up to one month before the expected calving.The German Animal Welfare Act prohibits the use of a device that, through direct exposure to electricity, significantly restricts the species-appropriate behaviour of an animal, in particular its movement, or forces the animal to move and thereby causes the animal considerable pain, suffering or harm. However, the use of physical (visible) electric fences outdoors is allowed.

In Ireland, Statutory Instrument 108 of 2014 prohibits the use of electro-immobilisation, stating that a person shall not use any electrical equipment or instrument, which applies a sustained electric current or impulse directly to a live animal

(a) as a means of restraining the animal,
(b) as a means of immobilising the animal, or
(c) for any other purpose.

Semen collection by electro-ejaculation is banned in several European countries (e.g. Denmark and The Netherlands).

Final remarks

In this paragraph, some final remarks are made regarding the categories of application of electrical devices as mentioned in the introduction, based on below listed references.

1. ***Electric fences:*** Traditional electric wire fences, with their pulsing currents, create a physical barrier and deter animals from attempting to breach the perimeter. However, very little research has been performed examining the welfare consequences of using an electrical wire fence. Training animals by using an electric shock is based on escape and avoidance conditioning and occurs as the animal learns to associate a specific behaviour or a particular location with the stimulus (9). The contact with the electrical wire is clearly aversive as indicated by escape behaviour and avoidance. The actual current that may flow to an animal varies according to the resistance of the hair, skin, body tissues and electrical circuit, which includes wires and any leakage of current to earth through wet insulators or vegetation in contact with the fence wire but, as Grumett and Butterworth (10) state, in order to serve as an effective boundary, an electric fence causes discomfort or pain and is designed to do so.
2. ***Virtual fences:*** The benefit of a virtual fence in comparison to traditional electrical wire fences is that the animals get a warning signal up to 20 seconds before they receive an electrical stimulus from the collar. After receiving one or more shocks, the animal learns through associative learning (warning signal) to avoid the fence line and further electrical shocks. Experiments on uncontrolled electrical shocks together with empirical experience and published data on cow's and sheep's ability to learn how to use a virtual fence, indicate that a virtual fence can be more animal welfare friendly compared to a traditional wire electrical fence due to the animal's ability to control avoiding an adverse electrical stimulus by reacting to the audio cue (11, 12). In a recent study in which various stress parameters were measured in dairy cows, no evidence of lasting adverse effects of virtual fencing on animal welfare were found (13). In a report on the welfare implications of using virtual fencing systems (1), it was concluded: "*Virtual fencing systems for livestock have several potential welfare advantages over conventional electric fencing. With appropriate provider safeguards and operator use, these include livestock nutrition, health and welfare benefits, and benefits to the land being grazed. These benefits are due to easy fenceline movement, the ability to apply audio and/or vibration cues prior to an electric shock, the ability of the system to deliver a known level of electrical pulse to an individual animal and associated monitoring functions.*"
3. ***Devices to move animals:*** The effectiveness of the various devices (e.g. backing gates, ticklers, cow trainers, electric prods) is based on the fact that they cause pain or discomfort. As indicated by Grumett and Butterworth (10), animals that are unable to move easily (e.g. due to lameness) are more frequently subject to any electric shocks from such devices. The same authors also point out that electrical devices may be applied to 'compensate' for instance poor design of handling races (e.g. straight rather than curved) or if animals experience shadows, contrasting light and dark areas, reflections or shadows etc. In several situations, the effectiveness of a device is not clear. For instance with cow trainers the majority of contacts is outside urination or defecation, thus reducing other behaviours such as autogrooming in the rear body parts. In the case of electric prods there is likely to be variability in its application depending on the attitude of the stockperson.
4. ***Electro-immobilisation*** appears to cause serious levels of stress and aversive behaviour in both sheep and cattle (13, 14, 15, 16, 17). A sub-committee to the Scientific Advisory Committee on Animal Health and Welfare in Ireland stated (18): *"The conclusion in relation to electro-immobilisation tended to be similar in all studies: it was difficult to justify electro-immobilisation use on welfare grounds, when more welfare-oriented alternatives are available."* And *"On balance, the use of electro-immobilisation is very difficult to justify. It is quite a cruel form of restraint, causing distress and aversive reactions, and because it is meant for single–pass use may increase the likelihood of minor surgical procedures being carried out cruelly, i.e. without analgaesia, as animals will only be caught once."*
5. ***Electro-ejaculation:*** There are relatively few scientific studies published on electro-ejaculation (19, 20). In their report on electro-ejaculation, the Irish Scientific Advisory Committee on Animal Health and Welfare (21) writes: *"Despite the limitations of the published studies, there is evidence to indicate that electro-ejaculation is a painful procedure, based on behavioural data, in particular vocalisations, and physiological indicators, blood cortisol and heart rate. In addition, epidural anaesthetic was shown to reduce pain responses to electro-ejaculation. Many of the studies on electro-ejaculation refer to animal welfare concerns over the use of this procedure."*

https://doi.org/10.5281/zenodo.11441129

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